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Edited by LEWIS STEPHEN PILCHER, M.D., LL.D., of New York

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ANTI-STAPHYLOCOCCIC EFFECTS OF THE INTRAARTERIAL INJECTION OF CERTAIN DYES *

REPORT OF INTRAARTERIAL INJECTIONS OF MERCUROCHROME 220-SOLUBLE;
GENTIAN VIOLET, AND ACRIFLAVINE IN THE TREATMENT OF EXPERI-
MENTAL STAPHYLOCOCCIC INFECTIONS IN DOGS

By ZUNG DAU ZAU, M.D.

OF PEKING, CHINA

AND

FRANK L. MELENEY, M.D.

OF NEW YORK, N. Y.

IN RECENT years intravenous dye therapy has been used in various clinics as a means to combat bacterial infections. Young and his co-workers^{1, 2, 3} have been the chief advocates of this form of treatment. Redewill, Potter and Garrison⁴ have treated large numbers of cases of gonorrhœal urethritis and its complications with gratifying results. Allen⁵ has satisfied himself of its efficacy. Scores of favorable reports have appeared in the literature. To bring forward the accumulated evidence with regard to the effectiveness of this form of treatment, Young³ in 1926 compiled 680 cases which had been treated with intravenous injections of dye. They comprised not only general infections, but also a large number of local lesions. Churchman,⁶ who has brought to light many facts with regard to the antiseptic action of gentian violet, has summed up the matter of dye therapy in a very conservative paper and concludes that the intravenous use of these dyes has, in many cases, an action which is definitely beneficial to the patient although its exact *modus operandi* is not yet understood. The dyes that have been most commonly employed are mercurochrome 220-soluble, gentian violet and acriflavine. The favorable reports have been, for the most part, clinical rather than experimental, although Walker and Sweeney,⁷ Sanner and Hill,⁸ and others have obtained experimental results which would seem to favor the rationale of dye therapy. On the other hand the results have not been regularly satisfactory. It is quite likely that many of the unfavorable results have never been reported—first, because of a natural reticence about reporting failures, and second, because a series of failures is always small and the method is not continued. And yet unfavorable reports have come both from clinics and from laboratories. Thibault⁹ warned against too sanguine hopes from intravenous dye therapy. Tenney and Lintz¹⁰ obtained negative results with acriflavine. Horsley's¹¹ results were not convincing. Simmons¹² could not be sure of any beneficial action with acriviolet or mercurochrome. Meyer, Sommer and Eddie¹³ concluded that mercurochrome failed utterly as a biliary antiseptic, as had been

* From the Research Laboratories of the Department of Surgery, College of Physicians and Surgeons, Columbia University, New York City.

claimed. Colebrook and Hare¹⁴ found no evidence of bactericidal action in the blood of animals injected with mercurochrome. Walker¹⁵ demonstrated that mercurochrome except in high concentration was not antiseptic in the presence of fresh defibrinated blood. Martin¹⁶ questioned the whole rationale of dye therapy as then in vogue (1925). St. George¹⁷ decried the use of mercurochrome on the basis of autopsy findings in treated cases. In general it may be stated that those who have reported failures have concluded either that the treatment was ineffective or that it was directly harmful and hastened rather than prevented death. To reconcile the reports of failure with the reports of successful results, several theoretical reasons have been offered.



FIG. 1.—Dog No. 9119. Effect of needle puncture on femoral artery one month after the injection of dye. It shows a thickened intima and a slightly broken internal elastic membrane. This represented the greatest degree of injury found.

Burke and Newton¹⁸ and others believe that some failures are due to improper preparation of the dye solutions. Thibault⁹ advances the theory, without experimental evidence, that the selective affinity of certain tissues both for dyes and bacteria is of prime importance. Many others maintain that these drugs are so much diluted following intravenous injection that bactericidal action is impossible. This was our own conclusion

after our investigation of acriflavine.¹⁹ We found, further, that a certain amount of the dye, injected intravenously, was quickly removed from the blood, held in the tissues and thus made unavailable as a bactericidal agent either in the blood or in the affected part. When a sufficiently large dose was given to render the blood bacteriostatic, destructive changes in such vital organs as the liver and kidneys became evident and resulted in the death of the animal.

Certain dyes have unquestionable bactericidal and bacteriostatic action on certain organisms *in vitro* and it seems rational to use these *in vivo* if they do not injure the body tissues unduly and if they can be made to reach the focus of infection in antiseptic concentration. Believing that most of the dyes in use are toxic if given intravenously in antiseptic concentration, it seemed reasonable to try to deliver the dyes through the arterial system directly to the lesion. We thought that under such circumstances a large part of the dye might be held at the focus of infection and only a small quantity be distributed about the body and held in vital tissues as is the case with intravenous injections. This report will demonstrate that our theory was incorrect.

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EXPERIMENTAL

Preliminary to the study of the effect of the dyes injected intraarterially on an infectious lesion, a series of experiments was done to determine the effect of the dyes on the animal as a whole when injected in that manner and the local effect of the needle and dye on the artery itself.

Throughout our experiments we have used mercurochrome 220-soluble supplied by Hynson, Westcott and Dunning, of Baltimore, gentian violet from Coleman & Bell, of Norwood, Ohio, and acriflavine "pro injectione" supplied by the National Aniline and Chemical Company, Inc., of New

York. All of these dyes were designed for intravenous use. They were prepared in 1 per cent. and one-tenth per cent. concentrations and were used while fresh, one or two hours after preparation. Three per cent. sodium bicarbonate or buffered distilled water, as suggested by Burke and Newton,¹⁸ were used as solvents for the dyes. The buffered distilled water solution

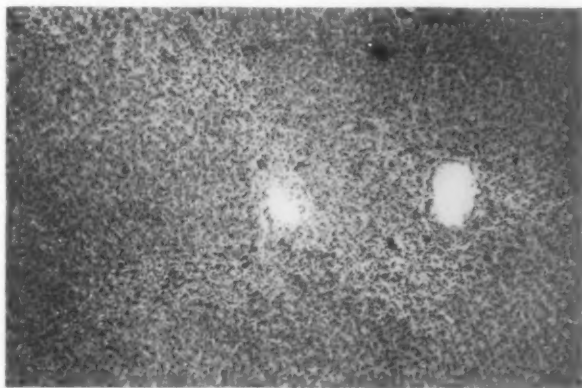


FIG. 2A.—Dog No. 8836 nineteen days after the injection of 5 mg. of mercurochrome per kilogram of body weight. Diffuse degeneration of liver.

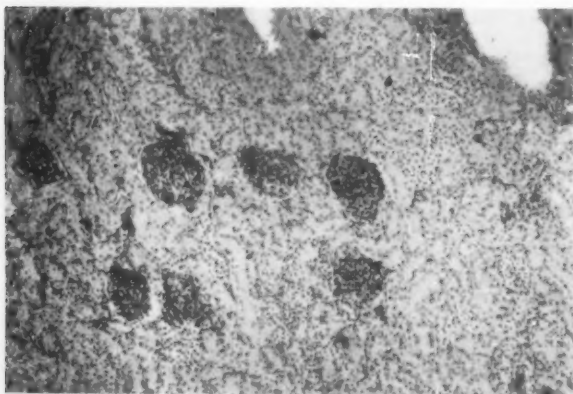


FIG. 2B.—Same dog as above. Sclerosis and round-celled infiltration of kidney glomeruli.

was prepared by adding 0.300 gm. of potassium dihydrogen phosphate and 0.387 gm. of dipotassium hydrogen phosphate to 100 cubic centimetres of distilled water. The dyes were then added to the solvents and the mixture warmed just enough to hasten the solution process. The solutions were finally allowed to cool down to room temperature

and filtered through filter paper. Sterilization of the dye solutions with heat was found to be unnecessary by Burke and Newton,¹⁸ because the dyes are sufficiently antiseptic to render themselves sterile, while heat will change the hydrogen ion concentration of the solvents, diminish the antiseptic power and increase the toxicity. In the preliminary experiments the dyes were injected with both solvents and in various doses. It was found that there

was a slight precipitate in the 1-100 mercurochrome in the buffered distilled water. In the later experiments, therefore, gentian violet and acriflavine were dissolved in buffered distilled water while the mercurochrome was dissolved in 3 per cent. sodium bicarbonate. In our experiments on the effect of

the dyes on the infectious lesion, we regularly used 5 mg. per kilogram of body weight as the unit dose.

For injection, we used Luer's 3-inch 22-gauge needles. This was found to be the smallest size which would deliver the dye rapidly into the circulation. In order to facilitate the introduction of the needle into the blood-vessel, the distal third was bent at a

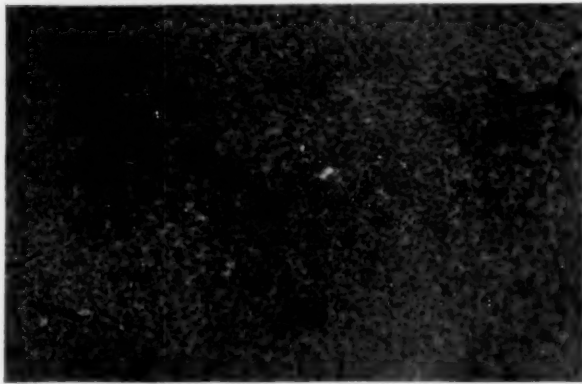


FIG. 3A.—Dog No. 8792 twenty-one days after injection of 10 mg. of gentian violet per kilogram of body weight. Focal degeneration of liver.

right angle. The needles were attached to a syringe with a small rubber tube. In our first experiments the injections were made into the abdominal aorta, about 2 centimetres above the bifurcation. This artery was chosen because it is a vessel comparable in size to the human brachial or femoral arteries and injections may be made very easily which will deliver the solution largely into one or the other lower extremity. In the later experiments, injections were made into the femoral artery in order to avoid the complication of a laparotomy.

The technic of the injection into the aorta was as follows: Under ether anaesthesia, the abdomen was opened by a low median incision. After the intestines were packed away from the field of operation, the abdominal aorta just above the bifurcation was steadied with

the fingers and the needle inserted into it through its anterior wall and guided into the right or left common iliac artery. Care was taken to minimize trauma to the vessel wall. To be sure that the needle was in the vessel and that no dye solution was retained in the rubber tubing, the injection of the dye was

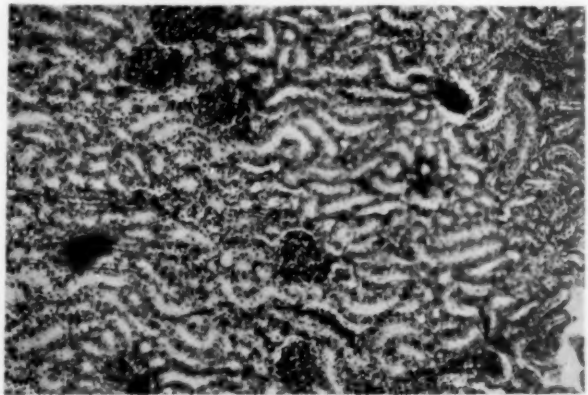


FIG. 3B.—Dog No. 8755 twenty-one days after the injection of 6 mg. of gentian violet per kilogram of body weight. Sclerosis and round-celled infiltration of kidney glomeruli, as well as a certain degree of cloudy swelling of the tubules.

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preceded and followed by normal saline solution. The dye was injected as rapidly as possible, avoiding leakage around the connections. At the conclusion of the injection the needle was gently withdrawn and immediately digital pressure was applied for a few minutes over the spot. By releasing this pressure at intervals of about a minute it was found that bleeding from the needle puncture rarely persisted for more than four or five minutes. Occasionally small local extravasation resulted, but this never became extensive enough to be of any consequence. Injections into the femoral artery were made through a small skin incision just below Poupart's ligament. Similar needles were employed.

The organism used to produce the lesion was a typical hemolytic *Staphylococcus aureus* isolated from a human infection. Twenty-four-hour broth cultures made from the stock culture were used throughout the experiment. With this organism we could produce constantly well-localized lesions in dogs. Redness, swelling, œdema, pain, tenderness, disability, fever from 101°–104° F., cellulitis and abscess were always present. The severity of the infection produced was fairly proportionate to the amount of the culture injected. In the first four instances 5 cubic centimetres of the culture were given. This was found to be unnecessarily large and it was therefore reduced to 2 cubic centimetres and finally to 1 cubic centimetre. The injections were made on the lateral aspect of one of the hind legs in a pair of dogs of approximately the same size and breed. Treatment was begun twenty-four, forty-eight or seventy-two hours after the injection of the organisms. We believe that only rarely would treatment in human cases be instituted before that time.

RESULTS

A. *Effect of the Dyes on the Animal and the Effect of the Needle on the Blood-vessel.*—Twelve normal dogs were selected and divided into three groups of four each. Of the first group, two dogs were given mercurochrome 220-soluble in buffered distilled water, and two dogs mercurochrome in 3 per cent. sodium bicarbonate solution. The dosage varied from 2.5 mg. to 16.6 mg. per kilogram of body weight. Death promptly followed the injection of this latter dose and another dog was substituted and given a smaller dose. Of the second group, two dogs were given gentian violet in sodium bicarbonate and two gentian violet in buffered distilled water. The total amount of the dye received by each was 45 mg., 10 mg., 100 mg. and 15 mg. respectively. Through error the dogs of this group were not weighed before the injection and consequently the exact dosage per kilogram of body weight is not known but it was estimated to be from 1.5–10 mg. per kilogram. In the third group two dogs were given acriflavine in sodium bicarbonate and two others acriflavine in buffered distilled water. The dose varied from 1.6 mg. to 5.2 mg. per kilogram of body weight. The results of these preliminary experiments are shown in Table I.

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TABLE I.

Showing the Effect of the Dye on the Dogs and the Needle Puncture on the Arteries.

Dog No. 8794. Dye solution used—mercurochrome in buffered water. Dose—2 mg. per kg. Lived twenty-one days. Cause of death—killed. Pathological findings at autopsy—Artery—thickened intima; loss of internal elastic membrane. Organs normal except kidneys; heavy glomerular round-celled infiltration.

Dog No. 8836. Dye solution used—mercurochrome in buffered water. Dose—5 mg. per kg. Lived nineteen days. Cause of death—lung abscess. Pathological findings at autopsy—Artery—slightly thickened intima. Organs—Lungs—multiple abscesses. Kidney—general but especially glomerular round-celled infiltration. Liver—diffuse degeneration.

Dog No. 8795. Dye solution used—mercurochrome in buffered water. Dose—16.6 mg. per kg. Lived one day. Cause of death—suppression of urine. Pathological findings at autopsy—Artery—slight hæmorrhage in wall. Organs—no change seen except kidneys—glomeruli choked with red-cells, polymorphonuclears and cellular debris; tubular degeneration.

Dog No. 8806. Dye solution used—mercurochrome in sodium bicarbonate. Dose—2.5 mg. per kg. Lived twenty days. Cause of death—diarrhœa. Pathological findings at autopsy—Artery—irregular thickening of wall. Organs—no change except kidneys—glomerular round-celled infiltration.

Dog No. 8807. Dye solution used—mercurochrome in sodium bicarbonate. Dose—5 mg. per kg. Lived twenty-eight days. Cause of death—killed. Pathological findings at autopsy—Artery—thickened intima; break in internal elastic membrane. Organs—Liver—congestion and patchy necrosis. Kidneys—diffuse round-celled and polymorphic infiltration.

Dog No. 8793. Dye solution used—gentian violet in buffered water. Dose—1.5 mg. per kg. Lived twenty-one days. Cause of death—killed. Pathological findings at autopsy—Artery—thickened intima. Organs—no change except kidneys—hyaline changes in glomeruli, sinusoids choked with red-cells.

Dog No. 8792. Dye solution used—gentian violet in buffered water. Dose—10 mg. per kg. Lived twenty-one days. Cause of death—killed. Pathological findings at autopsy—Artery—thickened intima. Organs—Liver—focal necrosis. Kidneys—diffuse cloudy swelling of tubules and sclerosis and round-celled infiltration of glomeruli.

Dog No. 8767. Dye solution used—gentian violet in sodium bicarbonate. Dose—1 mg. per kg. Lived twenty-one days. Cause of death—killed. Pathological findings at autopsy—Artery—thickened intima. Organs—Liver—patchy areas of degeneration. Kidneys—glomerular round-celled infiltration. Lungs—inflammatory exudate.

Dog No. 8755. Dye solution used—gentian violet in sodium bicarbonate. Dose—6 mg. per kg. Lived twenty-one days. Cause of death—killed. Pathological findings at autopsy—Artery—thickened intima, blood pigment. Organs—no changes except kidneys—glomerular round-celled infiltration.

Dog No. 8808. Dye solution used—acriflavine in buffered water. Dose—2 mg. per kg. Lived twenty-eight days. Cause of death—killed. Pathological findings at autopsy—Artery—slightly thickened intima. Organs—no changes except liver which shows slight diffuse degeneration.

Dog No. 8809. Dye solution used—acriflavine in buffered water. Dose—5 mg. per kg. Lived twenty-eight days. Cause of death—killed. Pathological findings at autopsy—Artery—slightly thickened intima. Organs—Liver—patchy necrosis and cellular infiltration. Kidneys—some tubular degeneration and glomerular sclerosis.

Dog No. 8823. Dye solution used—acriflavine in sodium bicarbonate. Dose—1.5 mg. per kg. Lived thirty-two days. Cause of death—killed. Pathological findings at autopsy—Artery—thickened intima. Organs—post-mortem changes in kidneys, liver and lungs. Spleen—large areas of necrosis.

Dog No. 8822. Dye solution used—acriflavine in sodium bicarbonate. Dose—4 mg.

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per kg. Lived thirty-five days. Cause of death—killed. Pathological findings at autopsy —Artery—thickened intima. Organs—extreme congestion of liver and kidneys.

Only three dogs showed any ill-effects following the injection of the dyes into the aorta. All three of these had received mercurochrome. One received a unit dose of 5 mg. per kilogram of body weight of mercurochrome in buffered distilled water. He died with multiple pulmonary abscesses. Diffuse round-celled infiltration was found in the kidneys and diffuse degeneration of the liver. One other received half the unit dose in sodium bicarbonate. This dog developed diarrhoea the next day and died twenty days later. Glomerular round-celled infiltration of the kidneys, slight injection of the intestinal wall and a few enlarged oedematous lymph-glands in the mesentery were present at autopsy. Whether mercurochrome was responsible for the diarrhoea and death in this case is not certain. The third dog received three and three-fifths times the unit dose of mercurochrome in buffered distilled water. Within a few hours he became violently ill with persistent vomiting and scanty reddish-yellow urine. The skin of the hind leg on the injected side was pink in color. The dog succumbed within twenty-four hours of the injection. At autopsy the skin and the muscles of the leg on the injected side and the cortices of both kidneys were found to have been stained pink. The remaining dogs all survived the injections and were killed with chloroform at the end of three to five weeks. Immediate autopsies were performed on all the animals, paying particular attention to that part of the abdominal aorta where the injection was made, to determine the effect of the needle puncture on the vessel. There was no evidence of thrombosis of the vessels. In some instances no trace of the needle puncture could be made out, while in others the only macroscopic evidence of the needle puncture was a faint brownish spot. The abdominal and thoracic organs presented no gross pathology. Microscopic studies of the wall of the aorta at the point of injection, when it could be found, showed at most a slight proliferation of the intima with a break in the internal elastic membrane.

The effect of the dyes on certain of the organ tissues is indicated in the brief description of the pathological findings in Table I. It is evident that even when the animals survived, following doses as small as 1 mg. per kilogram of body weight, after three or four weeks there was evidence of damage to kidney, liver or both and, with the larger doses, very extensive destruction of these tissues occurred. The pathological examinations seemed to show that gentian violet was least toxic and this was therefore used more than the other dyes in the later experiments. Pathological changes are shown in Figs. 1, 2, 3 and 4.

B. *The Effect of Intraaortic Injections of Dyes on Local Staphylococcus Lesions in the Leg.*—The lesions were produced in a pair of dogs by injecting equal amounts of whole staphylococcus culture into the subcutaneous tissue of the outer side of the hind leg. The dogs were examined daily and temperatures were taken. When the time came for injection of dye, if there was any difference between the extent or degree of the lesion in the two animals, the dog showing the more severe lesion was selected for treatment. The dog to be treated was prepared and anaesthetized in the same manner as in the preliminary experiments. The abdomen was opened and the dye injected through the aorta into the iliac artery on the side of the lesion. The first control dogs were not subjected to any operation. With the last pair, however, the control dog was operated upon and saline was injected instead of dye. The results of these tests are shown in Table II.

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TABLE II.

Showing the Effect of Intraaortic Injection of Dye on Local Infection.

Dog No. 8844. Dose bacteria—5 c.c. Time of treatment—72 hours. Dye solution used—gentian violet in buffered water. Dose—5 mg. per kg. Died fourth day. Pathological findings at autopsy—(positive culture of hemolytic staphylococcus from peritoneum at time of injection of dye). Artery—thickened intima, broken internal elastic membrane. Organs—Lungs—œdema. Liver—diffuse hepatitis. Spleen—miliary abscesses. Kidneys—diffuse cellular infiltration. Muscle necrosis and cellular infiltration. Positive blood culture.

Dog. No 8843. Dose bacteria—5 c.c. Normal sixth day. Autopsy—not examined.

Dog No. 8865. Dose bacteria—5 c.c. Time of treatment—72 hours. Dye solution used—gentian violet in buffered water. Dose—5 mg. per kg. Died fifth day. Pathological findings at autopsy—(positive culture of hemolytic staphylococcus from peritoneum at time of injection of dye). Artery—very little evidence of injury. Organs—Lungs—œdema and exudate. Pleural fluid, peritoneum and blood positive culture. Liver—degeneration around central vein. Spleen—polymorphic infiltration. Kidneys—congestion and capillary hæmorrhage.

Dog No. 8864. Dose bacteria—5 c.c. Normal twelfth day. Autopsy—not examined.

Dog No. 8890. Dose bacteria—2 c.c. Time of treatment—24 hours. Dye solution used—gentian violet in buffered water. Dose—5 mg. per kg. Died fifth day. Pathological findings at autopsy—Artery—thickened intima; active fibroblasts of early repair. Organs—Peritonitis positive culture. Blood culture negative. Kidneys—cloudy swelling. Liver and lungs congested.

Dog No. 8889. Dose bacteria—2 c.c. Normal ninth day. Autopsy—not examined.

Dog No. 8918. Dose bacteria—2 c.c. Time of treatment—24 hours. Dye solution used—acriflavine in buffered water. Dose—5 mg. per kg. Normal eleventh day. Autopsy—not examined.

Dog No. 8917. Dose bacteria—2 c.c. Normal seventh day. Autopsy—not examined.

Dog No. 8928. Dose bacteria—2 c.c. Time of treatment—48 hours. Dye solution used—acriflavine in buffered water. Dose—5 mg. per kg. Normal sixth day. Died seventeenth day. Pathological findings at autopsy—Artery—thickened intima; frayed out internal elastic membrane. Organs—Liver—diffuse hepatitis and necrosis. Kidney and spleen—diffuse degeneration. Lungs—lobular pneumonia.

Dog No. 8929. Dose bacteria—2 c.c. Normal third or fourth day. Autopsy—not examined.

Dog No. 8953. Dose bacteria—1 c.c. Time of treatment—48 hours. Dye solution used—acriflavine in buffered water. Dose—5 mg. per kg. Died eighth day. Pathological findings at autopsy—Artery—thickened intima; loss of internal elastic membrane. Organs—Liver—patchy necrosis. Lungs—pneumonia and focal abscesses. Kidneys—cloudy swelling. Spleen—congestion.

Dog No. 8954. Dose bacteria—1 c.c. Normal fourth or fifth day. Died twenty-sixth day. Pathological findings at autopsy—pneumonia. Tissues not examined.

Dog No. 9093. Dose bacteria—1 c.c. Time of treatment—24 hours. Dye solution used—mercurochrome in sodium bicarbonate. Dose—5 mg. per kg. Normal seventeenth day. Autopsy—not examined.

Dog No. 9094. Dose bacteria—1 c.c. Injection solution used—normal saline. Normal tenth day. Died seventeenth day. Pathological findings at autopsy—distemper. Tissues not examined.

The treated dogs in which infection was produced with 5 cubic centimetres of staphylococcus culture, died on the fourth and fifth day in spite of the dye therapy, while the controls recovered. Of those dogs which had a smaller dose of hemolytic staphylococcus, one treated with gentian violet died on the fifth day and one treated with acriflavine devel-

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oped bloody diarrhoea and died on the eighth day. The difference in the number of days that these dogs took to recover from the infection is striking. In no instance did a treated dog return to normal before its control. An average of eleven and three-tenths days were required for the treated dogs which survived to overcome the infection, and seven and two-sevenths days for the controls.

C. The Effect of Injection of Dye into the Femoral Artery on the Local Staphylococcus Lesions in the Leg.—The lesions were produced in the same way as in the preceding series. The injection of dye was made on the designated day following the development of the infection. The femoral artery was exposed below Poupart's ligament and the injection was made in the same manner as in the aorta. The control dogs were subjected to the same operative procedure as the treated dogs, but normal saline was given instead of the dye. The results are shown in Table III. In none of the dogs was there observed any circulatory disturbance in the leg suggesting thrombosis of the artery as a result of the injection. At autopsy the intimal surface of the artery was always found to be smooth and the needle puncture was occasionally marked by a very faint brown spot. In those specimens which were examined microscopically, a thickening of the intima was found without any loss of internal elastic membrane. (See Fig. 1.) The operative wounds healed by primary union in all cases and there was no evidence of the infection having been aggravated by the operative procedure except in one instance in which, after treatment with dye, the infection increased and spread upward to the abdominal wall the day following the operation. This dog was finally killed with chloroform and culture of the peritoneal cavity showed hemolytic staphylococcus aureus and bacillus coli. The other dogs all survived. The treated dogs returned to normal after an average of twelve and two-tenths days, while the control dogs became normal after an average of five days, excluding one dog in which the ulcer resulting from the sloughing of part of the skin over the infection refused to heal. This dog developed distemper on the third day and died on the thirty-fourth day.

TABLE III.

Showing the Effect of Intraarterial Injections of Dye Into Femoral Artery on Side of Local Lesion.

Dog No. 9119. Dose bacteria—1 c.c. Time of treatment—twenty-four hours. Dye solution injected—gentian violet in buffered water. Dose—5 mg. per kg. Appearance of lesion day of operation—leg swollen and hot, with discolored areas. Normal, general, tenth day; local, twenty-second day.

Dog No. 9118. Dose bacteria—1 c.c. Time of treatment—twenty-four hours. Solution injected—saline. Appearance of lesion day of operation—leg swollen, tense and hot. Normal, general, seventh day; local, oo. Died twenty-fourth day.

Dog No. 9167. Dose bacteria—1 c.c. Time of treatment—forty-eight hours. Dye solution injected—gentian violet in buffered water. Dose—5 mg. per kg. Appearance of lesion day of operation—leg swollen, hot, red and disabled. Moribund sixth day—(chloroformed).

Dog No. 9166.—Dose bacteria—1 c.c. Time of treatment—48 hours. Solution injected—saline. Dose—5 mg. per kg. Appearance of lesion day of operation—leg swollen, hot, red and disabled. Normal third day.

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Dog No. 9270. Dose bacteria—1 c.c. Time of treatment—24 hours. Dye solution injected—mercurochrome in sodium bicarbonate. Dose—5 mg. per kg. Appearance of lesion day of operation—leg swollen, hot, red and disabled. Normal eighth day.

Dog No. 9269. Dose bacteria—1 c.c. Time of treatment—24 hours. Solution injected—saline. Dose—5 mg. per kg. Appearance of lesion day of operation—leg swollen, hot, red and disabled. Normal sixth day.

Dog No. 9190. Dose bacteria—1 c.c. Time of treatment—48 hours. Dye solution injected—mercurochrome in sodium bicarbonate. Dose—5 mg. per kg. Appearance of lesion day of operation—leg swollen, hot, red and disabled. Normal fourteenth day.

Dog No. 9189. Dose bacteria—1 c.c. Time of treatment—48 hours. Solution injected—saline. Dose—5 mg. per kg. Appearance of lesion day of operation—leg slightly swollen, moderate disability. Normal third day.

Dog No. 9300. Dose bacteria—1 c.c. Time of treatment—24 hours. Dye solution injected—acriflavine in buffered water. Dose—5 mg. per kg. Appearance of lesion day of operation—leg swollen, hot, red and disabled. Normal ninth day.

Dog No. 9299. Dose bacteria—1 c.c. Time of treatment—24 hours. Solution injected—saline. Dose—5 mg. per kg. Appearance of lesion day of operation—leg swollen, hot, red and disabled. Normal seventh day.

Dog No. 9316. Dose bacteria—1 c.c. Time of treatment—48 hours. Dye solution injected—acriflavine in buffered water. Dose—5 mg. per kg. Appearance of lesion day of operation—leg moderately swollen, slightly red; disabled. Normal eighth day.

Dog No. 9317. Dose bacteria—1 c.c. Time of treatment—48 hours. Solution injected—saline. Dose—5 mg. per kg. Appearance of lesion day of operation—leg moderately swollen, slightly red; disabled. Normal sixth day.

DISCUSSION

Our experiments demonstrate that small needles may be inserted into dogs' arteries as large as the aorta and as small as the femoral without causing a thrombosis or an aneurism and without significant injury to the wall itself. The concentration of dye as it reaches the site of infection depends upon the concentration of the solution and the speed of injection. It is certainly considerably greater than when the dye is injected intravenously. How much of the dye reaches the lesion in this concentration is problematical. At most it can only be that portion which enters the blood-vessels going to that focus and must be a very small part of that which is injected. The larger portion passes into the tissues, is taken up by the endothelial cells, or passes over to the venous side. Probably the largest quantity passes over and behaves as if it were injected intravenously. Certainly in our experiments enough dye passed through the peripheral capillaries to damage the liver and kidneys even when given in small doses.

Considering only that portion of the dye which enters the vessels leading to the site of the infection, it is evident that where the pathways are clear some of the dye may be taken up by the infected tissues and come in contact with the organisms, while some passes through the capillaries and enters the venous side. Also where the pathways are closed, as by thrombosed blood-vessels, the dye cannot come in contact with the organisms in the tissues. The question at once arises whether it is ever possible to bring any chemical into contact with bacteria diffusely scattered through the tissues

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as in cellulitis or localized as in abscesses. An area of cellulitis might be infiltrated with such a drug, but it would seem that only the periphery of an abscess could be reached. The ideal drug sought by chemotherapeutists is, of course, one which will not be held by any tissue nor cells other than the organisms which are being combated and one which will not be withdrawn from the circulation until contact is made with all the available organisms. It must first of all be readily diffusible through capillary walls and the capillaries must be open for its entrance into them. The chemical should not be one that will be fixed by tissue-cells but on the other hand should have a

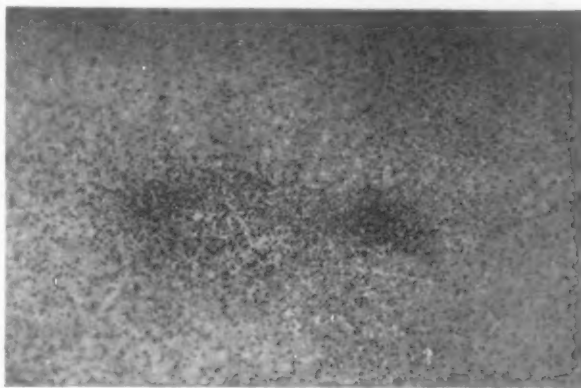


FIG. 4A.—Dog No. 8809 twenty-eight days after the injection of 5 mg. of acriflavine per kilogram of body weight. Focal degeneration of liver.

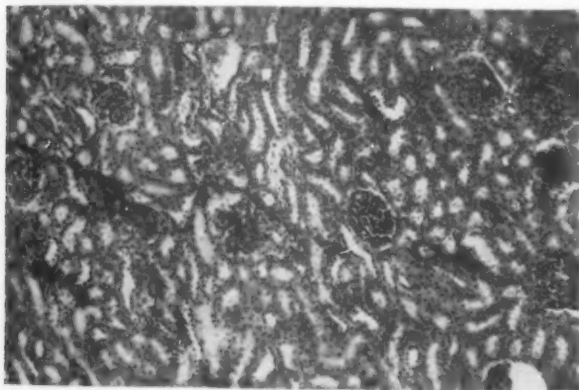


FIG. 4B.—Same dog as above. Glomerular and tubular injury of kidney.

selective affinity for bacteria. We can only say that there is no evidence at hand that the dyes used in these experiments fulfill these requirements. Intraarterial injection is theoretically better than intravenous injection because it delivers to the part affected the dye in "antiseptic concentration", at least

for one cycle. That portion which passes over into the veins becomes diluted in the same way as if it were injected directly into the veins, and much of it becomes fixed in organ tissues throughout the body. Inasmuch as intraarterial injection may be done safely, this would seem to be the method of choice when a drug is found which will have

some or all of the ideal physical and chemical properties mentioned above. It was of particular interest to obtain a positive culture of hemolytic *Staphylococcus aureus* in the peritoneal fluid of the dogs receiving the large dose of organisms in the leg. The dogs which were injected with dye died, but the control dogs which were not injected with dye lived. Although we cannot be certain that the control dogs had living organisms in the peritoneal fluid, it seems reasonable to think that they had, and may have survived because they were not subjected to the peritoneal trauma of operation as were

the treated dogs which were injected with dye. It is supposed that the organisms entered the peritoneal cavity by lymphatic extension upward from the thigh. In view of this result we were surprised to find that an incision into the tissues of the groin in the series of femoral artery injections did not result in a local infection at the site of injection. The dosage of organisms in the latter series was, however, much smaller.

It is significant, we think, that not one treated dog in either series returned to normal before its control. It is true that the dog with the worse lesion in every instance was used for treatment in order to favor the control, but there was not enough virtue in the medication to offset this handicap in a single case. On the other hand, the results suggest that the medication may have been a factor in retarding the return of the tissues to normal, but of this we cannot be certain. The lesions of the kidney and liver in the first group of dogs suggest that the dyes may, indeed, interfere with certain functions of the liver and kidney which are important for the resistance to infections in these animals.

SUMMARY

1. Certain experiments have been carried out in an attempt to demonstrate the effect of the dyes mercurochrome 220-soluble, gentian violet and acriflavine when injected into the aorta or the femoral artery of dogs.

2. In a series of thirteen dogs these dyes were injected into the aorta after solution either in buffered distilled water or in 3 per cent. sodium bicarbonate in concentrations of 1/100 and 1/1000 and in dosage varying from 1 to 16 mg. per kilogram of body weight. The effects of the needle puncture and the dye on the artery and the dye on certain organ tissue were observed. In no instance was there more than a trivial injury to the artery. No thromboses nor aneurisms occurred. No hæmatomas formed. In every instance even with the smaller doses there was some evidence of injury to the liver or kidney or to both, and with the larger doses there was extensive destruction of those organs when examined three to five weeks later. One dog died within twenty-four hours of injection with mercurochrome.

3. In a series of fourteen dogs acute inflammatory lesions were produced by injecting cultures of hemolytic *Staphylococcus aureus* into the subcutaneous tissues of the leg. In half of these dogs, the dyes were injected into the aorta in dosage of 5 mg. per kilogram of body weight—twenty-four, forty-eight or seventy-two hours after the injection of the organisms. In no instance was there any evidence of delay or inhibition of the infection in the injected animals. Four of the treated animals died, while the corresponding control dogs, not receiving any treatment, survived. The other treated animals required on the average eleven and three-tenths days to return to a normal condition. The control dogs which were untreated returned to normal on an average of seven and two-sevenths days.

4. In a series of twelve dogs acute inflammatory lesions were produced in the same manner as in the preceding series. In half of these dogs the

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dyes were then injected into the femoral artery on the side of the lesion. In the six control dogs saline was similarly injected. One of the treated dogs died with an extension of the infection. One dog receiving dye and another receiving saline developed distemper. Of the other treated dogs there was no evidence of any delay or inhibition of the infection. The treated dogs required on the average twelve and two-tenths days to return to normal. The control animals became normal after an average of five days.

CONCLUSIONS

1. Intraarterial injection may be accomplished in dogs without injuring the artery significantly.

2. In our experiments there is no evidence that the intraarterial injection of the dyes, mercurochrome 220-soluble, gentian violet and acriflavine, in doses of 5 mg. per kilogram of body weight, given twenty-four to seventy-two hours after the local injection of organisms into the leg, in any way affects the course of a local experimental hemolytic staphylococcus aureus infection other than to prolong it.

3. The intraarterial injection of these dyes in doses ranging from 1 to 16 mg. per kilogram of body weight is regularly followed by damage to the kidneys or liver which persists for a month or more.

4. With the failure of this method of delivering the dye in concentrated form directly to the lesion through arterial channels, it could hardly be expected that intravenous injections of the same quantity would be efficacious in similar conditions.

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MYELOMA OF THE SPINE

By DONALD C. DURMAN, M.D.

OF SAGINAW, MICH.

FROM THE ORTHOPEDIC DIVISION, HENRY FORD HOSPITAL

IN A recent article, Geschicter and Copeland¹ review all the literature and summarize the available data on all cases of multiple myeloma which have been reported since 1848. These authors give a fairly comprehensive review of our present knowledge of history, etiology, clinical characteristics, and treatment of the condition. In this paper I wish to report in detail another case of multiple myeloma, with particular reference to the diagnosis of the disease as it attacks the spine. The above authors do not emphasize this feature. Osgood and others have pointed out the difficulties in the ante-mortem diagnosis of myeloma of the spine, but none of them has given a very clear conception of the criteria upon which the diagnosis may be based.

From time to time during the study of the case here reported, various diagnoses were suggested by the symptoms and signs present. The patient gave a history suggesting a degenerative disease covering a six months' period prior to coming under observation. His history also suggested tuberculosis, and upon several occasions the chest findings tended to bear out this diagnosis. There was a peculiar blood picture which could not be explained upon the basis of any condition of which we were aware. Interesting alteration in the blood chemistry was also noted. There were never any symptoms referred to the long bones, pelvis or skull, and yet at autopsy these structures were found to be widely invaded by tumor. Because of the unusual and apparently misleading symptoms, the physical, röntgenological and pathological findings, it will be of interest and value to present the detailed history and laboratory data.

CASE REPORT.—A Roumanian laborer, age thirty-one, came with the complaint of weakness dating from an acute illness six months previously. This attack had been characterized by cough and pain in the right side of the chest. These symptoms persisted for six weeks. The patient never regained strength and was unable to return to work. He had lost about seventeen pounds weight. There were no symptoms referable to any other organs than the lungs, except for a recurring eruption on the arms and face. The rest of the past history and family history offered no clues as to the cause of the complaint.

Physical examination revealed evidence of recent weight loss. There was an extensive follicular eruption over the upper extremities and face. The percussion note over the right lower chest was markedly impaired and the breath sounds were diminished. A few dry wheezing rales were heard throughout the chest, and rather numerous fine subcrepitant rales over both bases. There was slight tenderness in the right flank on deep palpation but none over the lower ribs on the right. The spine revealed normal clinical findings. The temperature was normal but the leucocyte count was 16,000, with a differential count of 57 per cent. polymorphonuclears, 1 per cent. eosinophiles, 33 per cent. small mononuclears, and 9 per cent. large mononuclears. Urinalysis revealed a

few hyaline casts, red blood cells and a trace of albumin. The blood Wassermann was negative.

Because of the suspicious deep tenderness in the right flank, and the urinary findings, a kidney lesion was suspected. Routine röntgenograms were found negative. That portion of the ribs, spine and pelvis seen in these films appeared normal. A cys-

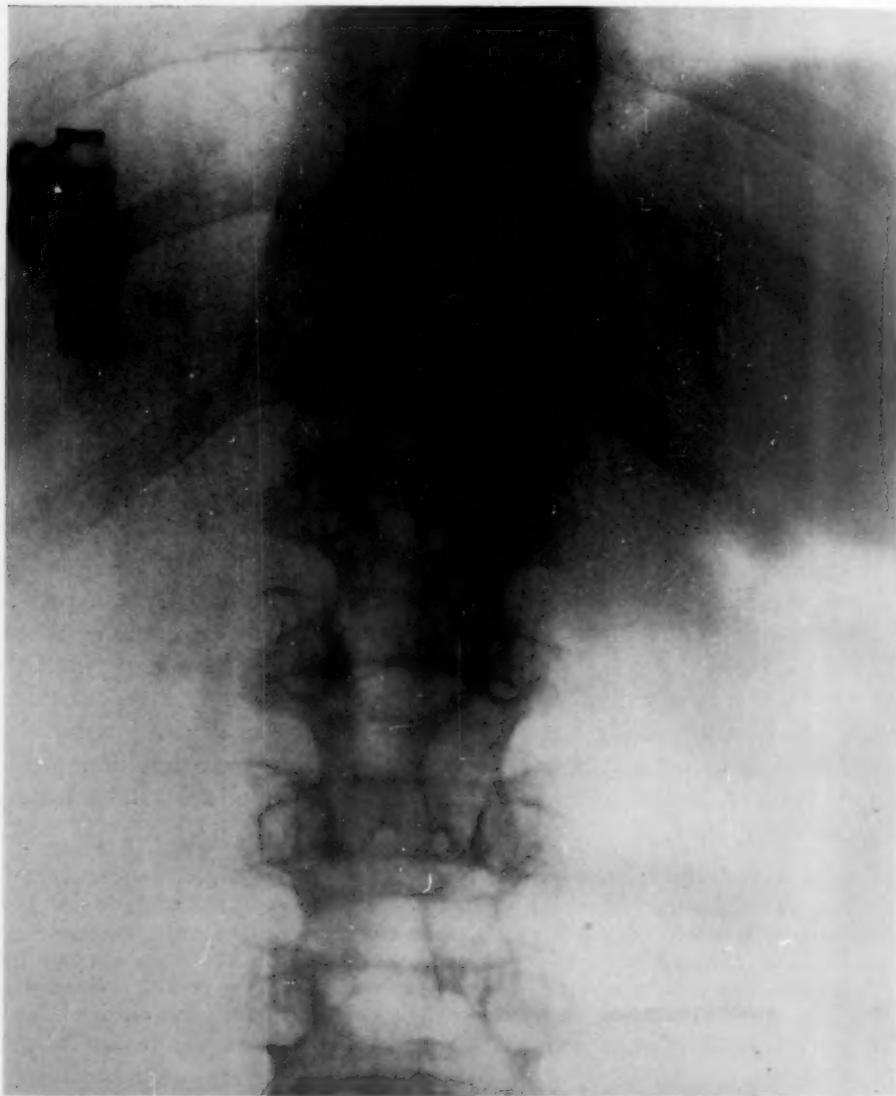


FIG. 1.—Showing marked osteoporosis of all vertebrae and definite narrowing of the twelfth dorsal and first, second and third lumbar.

toscopic examination was done and small calibre strictures of both ureters demonstrated. The urologists were uncertain as to the relation between these findings and the patient's symptoms.

Stereoscopic films of the chest gave evidence of a slight amount of fluid in the right costophrenic angle and of a tuberculous process in the left upper lobe. The ribs appeared normal.

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As the patient continued under observation the findings remained about the same. Both ureters were dilated. Urine from the kidneys did not contain pus and was negative to culture on ordinary media. At each visit the leucocytosis in the neighborhood of 17,000 persisted in spite of clearing of the skin infection and apparent resolution of the chest pathology.

About eight weeks after the original examination the patient was sent into the hospital on the medical service with a recurrence of chest pain and eruption on the face and arms, and with the additional new symptoms of nausea and vomiting. The admission temperature was normal but there was again a leucocytosis of 18,000 with a high polymorphonuclear count. The patient received symptomatic treatment and gradually improved. About a month later he developed pain in the back so severe at times that he would fall to the floor. It was then that he first came under my observation. I believe the physical findings at that time were characteristic of myeloma of the spine, but I did not recognize them. The patient stood in a slightly stooped position, the weight of the body carried forward on the balls of the feet, and the feet wide apart. The spine was practically straight, the normal anteroposterior curves being decidedly decreased. All motions were executed with extreme caution and were considerably limited and very painful. There was tenderness along the lower dorsal and lumbar spine, both over the articular facets and directly over the spinous processes.

Röntgenograms of the spine showed a fusiform shadow about the level of the eleventh dorsal vertebrae suggesting the possibility of a peri-vertebral abscess. The vertebrae and ribs appeared normal. I felt at this time that the symptoms and physical findings warranted a diagnosis of acute spinal arthritis, but that early Pott's disease, not demonstrable by X-ray, might be strongly suspected. Accordingly immobilization of the spine in plaster was advised and accepted by the patient.

Subsequent to the application of the plaster jacket the patient was very comfortable. A fortnight later the pain recurred with as much severity as before. The cast was



FIG. 2.—Showing circumscribed tumor in right femur. Fracture was produced with some force post-mortem.

removed and the patient placed on a Bradford frame. The following day he developed severe nausea, vomiting, distention and inability to pass flatus. Peculiarly, the temperature was normal but the leucocytes numbered 26,000, with 74 per cent. polymorphonuclears. The following day the leucocytes had risen to 39,000, and physical signs of an acute lobar pneumonia and symptoms suggesting an early meningitis had developed. The

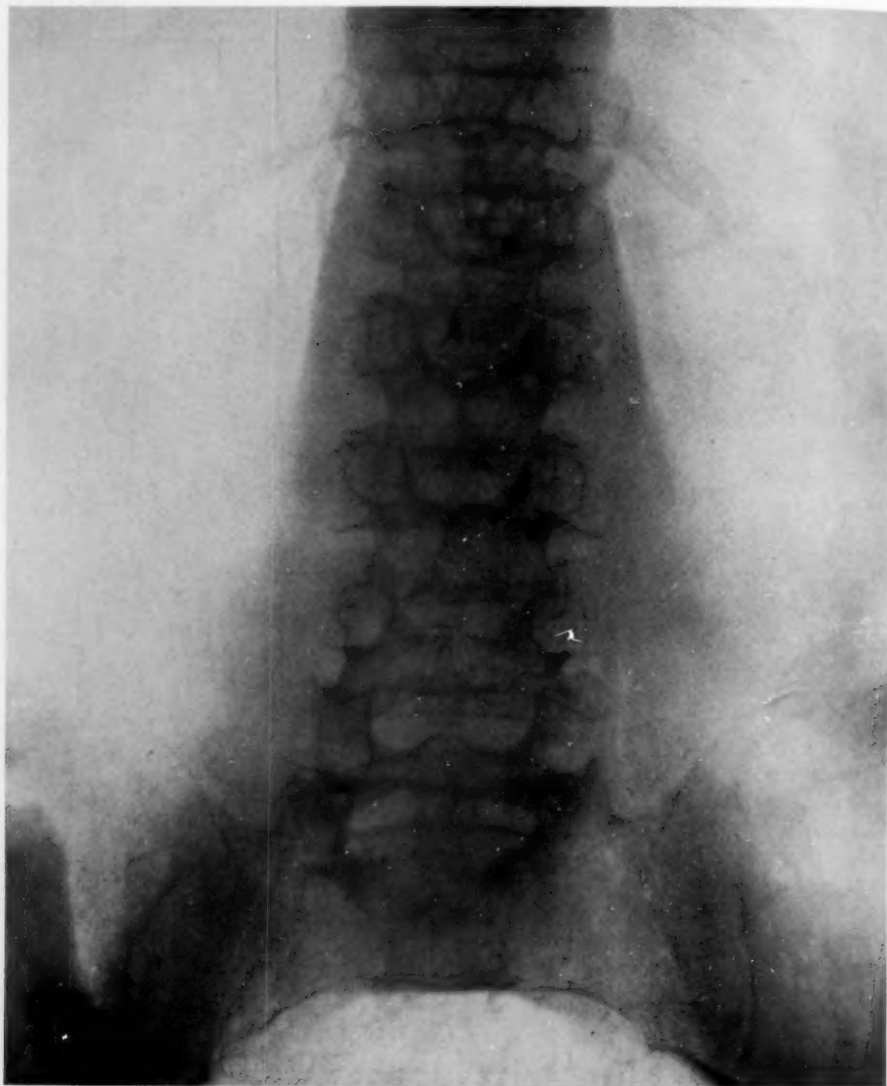


FIG. 3.—Taken post-mortem. Showing widespread involvement of all bones. Appearance of spine is typical. Compare lateral view (Fig. 5).

temperature rose to 103, the pulse was rapid and weak, but the respirations were normal in rate. Within four days the temperature had returned to normal, the above symptoms had all disappeared, but the leucocytes remained elevated. Repeated studies of blood smears showed slight change in size, shape and staining qualities of the red cells, occasional stippling of the red cells, but never any abnormal white cells. The color index was below 1.

A spinal puncture done because of the suspicious cerebral symptoms, revealed a

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typical paretic gold curve and a positive Pandy. It will be recalled that there was no history or clinical evidence of syphilis and that the blood Wassermann was negative.

Blood chemistry studies showed a non-protein nitrogen of 26, urea nitrogen 14.9, creatinine 1.5, sugar 91, phosphorus 3.36-4.08 and calcium 16.1. Unfortunately the importance of the abnormal calcium and its possible relationship to the disease were overlooked and only the single determination made.

From this time on, the patient's course was apparently one of gradual improvement with periods of relapse in which he was very ill. Röntgenograms of the spine (Fig. 1)

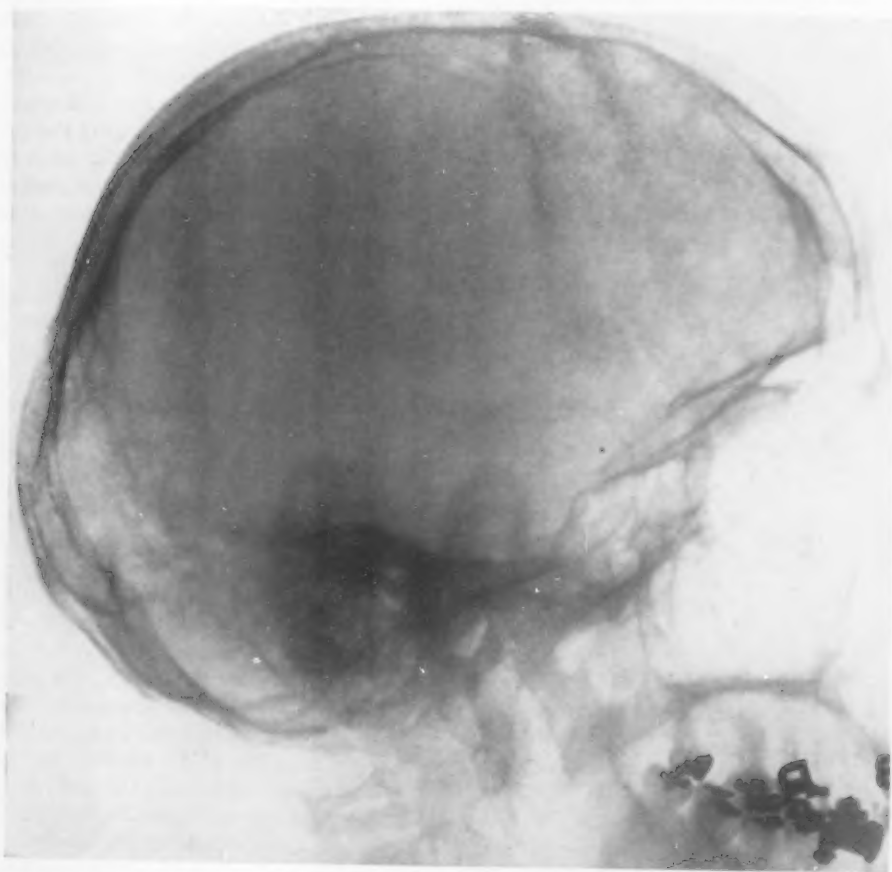


FIG. 4.—Showing typical "worm eaten wood" appearance of myeloma in skull.

taken about six weeks after the original ones, showed marked narrowing of the upper three lumbar vertebrae and of the last dorsal but no narrowing of the joint spaces. The lower ribs were normal. After a careful study of these films a diagnosis of myeloma was made on the basis of them. Because of the expense the patient would not permit X-ray studies of the entire skeleton. Bence Jones bodies were then demonstrated in two urine specimens after examining every specimen voided over a ten-day period.

The patient was then given deep X-ray therapy to the spine. Improvement was really remarkable. After two exposures he experienced complete relief of pain and was able to leave the hospital two weeks later. He was equipped with a spinal brace.

Of the subsequent history nothing is known. The patient died two months later at the county infirmary. The terminal symptoms were evidently pulmonary, as the

cause of death was given as tuberculosis. Fortunately I was able to have the body returned for an autopsy. This was performed by Dr. C. Z. Garber. A résumé of the important findings having a bearing on the subject of this paper follow.

Pathological Report.—It is worthy to note that the lungs showed no evidence of tuberculosis, either old or recent. Both pleural cavities were nearly completely obliterated by dense fibrous adhesions and the visceral pleura was very much thickened. There was considerable edema present.

There was no evidence of new growth in any of the viscera. The liver showed only chronic passive congestion. The spleen showed no gross evidence of pathological change.

The following dictation by the pathologist regarding the skeletal tissues is of particular interest.

"Section through the sternum shows a large central cavity filled with very soft coarsely granular, pinkish-red tissue. The ribs look to be smaller than normal. They are broken and cut with great ease. It is easier to cut the ribs than the costal cartilages. The central cavities of the ribs are small. They are filled with pinkish-red tissue. The right femur and upper third of the tibia and fibula are removed in one piece and longitudinal saw cuts are made through these bones. Externally they are not remarkable except for the fracture at the lower end of the femur, which was made while handling the body. The marrow cavity of the femur is seen to contain a very abundant amount of pinkish-red, coarsely granular, soft



FIG. 5.—Showing typical X-ray appearance of myeloma of the spine. Taken post-mortem with the spine dissected free and hemisected.

tissue. The cortex appears to be of normal thickness except at the ends of the bones, where it is thinned out to a mere shell. This is most marked in the lower end of the femur in the region of the fracture. There is no new bone formation. The area at the lower end of the femur shows the marrow cavity enlarged and occupied by a soft, mottled, pinkish-gray and brownish-gray tumor mass. Section of the tibia shows the marrow cavity rather large and containing yellow adipose tissue and showing some mottling of pink.

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Section of the fibula shows a small marrow cavity which is yellowish-pink in color. Except for the upper cervical region the vertebral column is removed intact, the ribs being cut easily by means of an ordinary knife. The vertebral column is sawed in two and the bodies of the vertebræ are seen to be pinkish-red in color. The bony trabeculae have largely been destroyed, and many of the vertebral bodies are filled with soft, coarsely granular, pinkish-red tissue which is not much different from hyperplastic bone marrow in appearance. The process of sawing through the vertebral column is done very easily, showing the great loss of bone. The intervertebral cartilages are intact.

"The skull is easily sawed through. The calvarium measures 5 to 6 mm. in thickness. There is a larger amount of pinkish-red, marrow-like tissue than is usually found. There are no large definite areas of tumor. Dura is not remarkable. Numerous sections of the brain show no abnormalities. The posterior clinoid processes of the sphenoid are much more easily broken than is usually the case."

At this point it is well to emphasize the fact that even though those parts of the femur, tibia and fibula which were removed from the body showed gross evidence of rather diffuse tumor involvement, only the ends of those bones revealed very definite X-ray evidence of the disease. Röntgenograms taken post-mortem of all the long bones showed rather circumscribed areas of rarefaction near the epiphyses.

Microscopic Notes.—Sections through the large mass of tumor at the lower end of the right femur show it to be composed of a network of rather small, definitely outlined, irregularly shaped cells with rather scanty bluish-pink staining cytoplasm often extending in the form of delicate processes and fairly large round oval nuclei which stain dark bluish-black or show chromatin in more open, coarsely granular form. A few mitotic figures are found. There is a lace-like, delicate, fibrous, connective tissue stroma and the tumor cells appear to grow out from it so that there is a suggestion of an alveolar arrangement. Capillaries containing red blood cells are occasionally visible in the stroma. There is a little variation in the size of the tumor cells and some have two nuclei. A few red blood cells are noted scattered among the tumor cells of certain areas but no normoblasts are identified. Several narrow bone trabeculae are seen with a good deal of rather loosely woven connective tissue round about.

A section taken through the marrow at the upper end of the right femur shows some evidence of normal bone marrow structure in that there are hollow spaces which are judged to have formerly contained fat. There is a delicate fibrous connective tissue stroma which is more diffuse and shows no suggestion of alveolar arrangement. There are some normoblasts and irregularly-shaped cells similar to those described above except that they contain numerous small pink or bluish-pink staining granules. Many cells show lobulated nuclei.

Another section from the upper end of the femur was made from a decalcified block. Some of the cortical bone remains but it is much thinner than normal. Bony trabeculae are numerous but smaller than normal. Some normoblasts, giant cells, and neutrophilic and eosinophilic myelocytes are seen, but most of the cells are of the more embryonic type.

Sections from the vertebræ show but little fat and the marrow cells are rather close together. Myelocytes of the neutrophile and eosinophile types, and a rather small number of normoblasts, red blood cells, polymorphonuclear neutrophiles, eosinophiles and giant cells are seen, but most of the cells are of the more embryonic type, such as have been described above. They are irregular in outline and vary somewhat in size but have a moderate amount of bluish-pink staining cytoplasm and relatively large nuclei which are round or oval and have their chromatin in a granular arrangement. Bony trabeculae are less numerous than normal and are long and very narrow. In some places they are surrounded by a zone of fibrous tissue which looks like compressed reticulum.

Another section from a decalcified block of vertebræ shows practically the same picture. The predominance of the embryonic type of cell is, however, even more marked. A few mitotic figures are seen. The cortex of the bone is largely destroyed and in

most areas the characteristic cells border directly and are sometimes seen to be invading the dense fibrous tissue of the periosteum.

Discussion.—Geschicter and Copeland emphasize the fact that the distribution of the tumors in multiple myeloma is perhaps the most outstanding diagnostic feature of the disease. These authors believe that there is multiple involvement of the ribs, sternum, or clavicles and spine in ninety per cent. of all cases, and that in rare instances the disease may involve the spine only or the ribs only. Ewing² states that the ribs and sternum form the usual original sites of the disease and that the skull, femur, pelvis and humerus are less often involved and in the order named. This is rather contrary to the idea conveyed by Geschicter and Copeland. In a report of thirteen cases from the Mayo Clinic, Meyerding³ gives the impression that the spine is rather often the seat of primary involvement.

While the evidence is inconclusive, it points to the primary involvement of the spine in the case here reported. It will be recalled that at no time while under my observation did this patient complain of pain referable to any bones except the spine and ribs. The chest pain was easily explainable on the basis of lung pathology, and repeated röntgenograms of the ribs were negative for signs of neoplasm. Also in favor of the spine as the primary site of the growth was the widespread involvement of all the vertebræ in spite of protection from the effect which weight bearing and motion might have had in disseminating the growth.

The first and most outstanding symptom in all reported cases of myeloma was pain. This may be rheumatic in character and rather indefinite at first. It may be referred to the corresponding nerve root areas. The pain is aggravated by movement or pressure and is subject to remissions and exacerbations. In the above patient, the initial attack of pain was brought on by cranking an automobile and was of sufficient severity to completely prostrate him. Geschicter and Copeland convey the idea in their report that in all cases of myeloma, back pain is characteristic, but they do not explain the mechanism of the pain. The cases of myeloma with spinal involvement which have been reported have had back pain as a common symptom. I believe this pain is due to erosion of the periosteum from within, by the advancing growth and to nerve root pressure accompanying the softening and collapse of the vertebræ. In the absence of definite spinal involvement back pain is difficult to explain.

The change in shape of the vertebræ mentioned above causes a progressive deformity of the spine. This is the next most characteristic clinical sign of myeloma of the spine. The stature may be actually reduced as in Paget's disease of the bone. The normal antero-posterior curves are changed as the vertebral bodies narrow. As pointed out by Geschicter and Copeland, the deformity of the trunk leads to a characteristic habitus or stance with protruding abdomen, and shoulders thrown back and the head forward, the feet well apart to give a wide base for standing.

The laboratory findings, while not particularly characteristic of myeloma of the spine, may be mentioned briefly as aids in diagnosis. In the majority of

MYELOMA OF THE SPINE

cases there is a secondary anaemia. The white blood cell and differential counts present certain peculiarities. These are discussed in detail by Geschicter and Copeland. Suffice it to say here that a leucocytosis has been present in twenty-three per cent. of reported cases and was explained frequently by the presence of secondary infection. In others it was probably due to the disturbance in the bone marrow. The leucocytosis in our patient was certainly disproportionate to infection and fever. It seems reasonable to expect some pathological change in the histology of the white blood cells and in the count. Careful blood studies should be made in all suspected cases.

The presence of Bence Jones bodies in the urine, often looked upon as a classical sign of the disease, has been noted as early as the eleventh week and as late as the fifth year. They may be present intermittently or continuously. They sometimes appear in showers similar to the appearance of casts in certain forms of nephritis. Meyerding⁴ believes these peculiar bodies to be present in the urine of eighty per cent of cases. They were found in half the cases reviewed by Ewing, but in the review of Geschicter and Copeland in sixty-five per cent. I am inclined to believe that they are present in all cases sometime during the course of the disease, but that they are difficult to find. Emerson⁵ states that in those cases in which Bence Jones protein is found in the urine, it is usually present in concentrations of less than one per cent. Most patients whose urine contains Bence Jones bodies die in less than two years. One should not have to wait until these bodies are demonstrated to make the diagnosis of myeloma.

While Baetjer and Waters⁶ state that myeloma is difficult if not impossible to diagnose by X-ray, Kolodny⁷ and Meyerding believe that X-ray is the single most important factor in the diagnosis. The typical röntgenogram of myeloma in all bones except the vertebrae resembles worm eaten wood, with numerous areas of decreased density which vary in size and shape, most typically seen in the skull (Fig. 4).

At this point it is well to emphasize the numerous mistakes made in hospital and private practice, and freely admitted by various well-known men in the diagnosis of myeloma of the spine. While these mistakes may not have had any appreciable influence on the outcome or progress of the disease, avoiding them may obviate useless treatment and lead to an earlier and more correct prognosis. The reasons for these errors are several. First, the possibility of the disease is seldom in one's mind when examining backs in which lesions of the vertebrae are suspected. Other factors which lead to incorrect diagnoses are the rarity of the disease, the scarcity of reports in English on the subject, and the peculiar clinical course and misleading physical findings. Last, and most important, are the rather confused ideas regarding the X-ray findings.

Turner⁸ states that the röntgenograms of his cases were inconclusive for spinal pathology. Osgood⁹ makes the same statement in a report of three cases observed by him. Gaube¹⁰ reports a case in which it was impossible to establish a correct diagnosis because the röntgen examination failed to reveal the true condition. Reviewing the photographic copies of röntgeno-

grams accompanying the last three mentioned reports, and comparing them with those shown by Meyerding and Kolodny, and with those of this report, one finds them practically identical. It seems that the typical X-ray picture of myeloma of the spine, that which has often been regarded as confusing and indefinite, is one of extensive rarefaction (Fig. 3 and Fig. 5) of the bone with flattening of the bodies of the vertebræ but not much narrowing of the intervertebral cartilages. The only other conditions which might present the same picture are the rapidly growing sarcomata arising from bone marrow. However, these conditions would have other distinguishing features. There should be no mistaking the diagnosis of myeloma of the spine in röntgenograms such as presented here, and especially when combined with a peculiar history similar to the one given in this paper, and with the clinical characteristics enumerated above.

The reason for the peculiar appearance of röntgenograms of myeloma of the spine as different from other bones is possibly explained by the structure of the vertebral bodies, where the total amount of compact bone is less than in other parts of the skeleton. Consequently the tumor is more rapidly destructive and infiltrating and finally replaces all the normal bone, leaving a very thin cortex.

SUMMARY AND CONCLUSIONS

1. Myeloma of the spine is a rare disease, but one which should be kept in mind when examining for spinal pathology.
2. The clinical course and findings are rather definite. The apparent indefiniteness of the clinical signs is itself typical.
3. The absence of Bence Jones bodies from the urine does not preclude the possibility of the disease. The presence of these bodies should serve as confirmatory rather than indicative evidence.
4. There is often a disturbance in the blood picture. The blood should be carefully studied in all suspected cases.
5. The röntgenological findings are diagnostic.

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TRANSBUCCAL APPROACH TO THE ENCEPHALON

IN EXPERIMENTAL OPERATIONS UPON CARNIVORAL
PITUITARY, PONS, AND VENTRAL MEDULLA

By ARTHUR JOHN McLEAN, M.D.

OF BOSTON, MASS.

ARTHUR TRACY CABOT FELLOW, LABORATORY OF SURGICAL RESEARCH, HARVARD MEDICAL SCHOOL

IN THE course of frequent experimental intracranial operations during the past year, a transbuccal approach to the entire medioventral surface of the di-, mes-, met-, and myel-encephalon has been evolved as a reliable survival procedure, with a total mortality of 11 per cent. for the series and without a single fatality in the last twelve of the seventeen operations. Despite the exceeding vascularity of the basilar fossæ, the procedure is practically bloodless when properly carried out. The second, fifth, sixth, and twelfth cranial nerves have been cut at their source under direct vision, without damage to closely contiguous structures, and many hypophysectomies have been done. It is not improbable that a visually controlled attack on the seventh-eighth nerve complex could be accomplished.*

Knowledge of the pituitary body has recently been extended (Camus and Roussy³) by the use of a more exact operative approach (Bailey and Bremer²; Dandy and Reichert⁵). A far-reaching hypothalamic (probably tuber cinereum) syndrome has been extricated with seeming definiteness from the hypopituitary complex described by Cushing.⁴ The development of experimental operative procedures has been sketched by Bailey and Bremer.² Gemelli,⁶ and later Aschner,¹ were the first to employ successfully a transbuccal route to the hypophysis. Aschner's operative methods enabled him to obtain results with only slight incidental injury to the tuber cinereum. His series of seventy-nine operations comprised sixty-three total hypophysial extirpations and sixteen partial. Tabulation of these reported total extirpations shows that about 17 per cent. died within the first three days (two instances of intentional tuber cinereum injury included), presumably of acute operative sequelæ; an additional 20 per cent. died during the first month, often of distemper but also in about 12 per cent. of the cases because of "palatal dehiscence and pneumonia". Dandy and Reichert's series of thirty-one dogs, in which a transtemporal procedure was used with puncture of the interpeduncular cistern and a "hanging brain" posture, had an immediate operative mortality of 16 per cent.

In 1923, Pollock and Davis⁸ described an operation for transbuccal approach to the basilar artery; their experiments were acute, no preparations

* Lateral column nerves of the medulla are more readily exposed by a posterior fossa ("cerebellar") exploration. The third and fourth nerves, and prepontine hypothalamus are more readily approached by a modified transtemporal route.

being kept longer than twenty-four–thirty-six hours. An elaboration of this was subsequently used by McLean⁷ for an aneurotraumatic approach to the pons.

Proper recognition of anatomical landmarks and an accurate visualization of underlying structures is necessary for proper placing of the necessary bony perforations. These are discussed below, but the accompanying

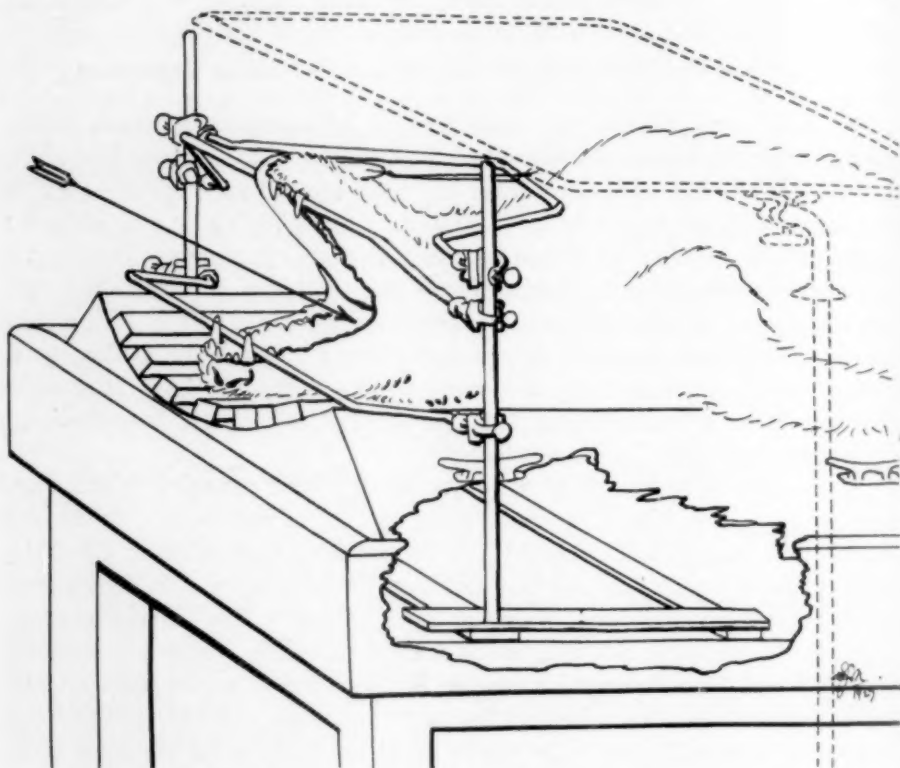


FIG. 1.—Gag used for oral exposure and head fixation during transbuccal operation; the dog is lying on his back. From a portable metal platform arise two brass uprights upon which are adjusted three bent metal rods whose radial angulations are controlled by adjustable lock nuts. The direction of the operative field shown in Fig. 2 is indicated by the arrow.

drawings cannot properly take the place of study of a prepared skull. The customary accessories of careful intracranial surgery are needed—a focusing beam headlight, a power drill, suction, irrigating saline, small cotton pledgets, bone wax, fresh muscle. An indispensable requisite is proper fixation of the head, and a wide oral exposure; this has been readily obtained by a sturdy modification of the gag devised by Pollock and Davis. It is essentially a steel platform (Fig. 1) with brass rod uprights, so fitted that it may be accurately inserted beneath the latticed operating bed; three cross-rods of the shape shown may be adjusted at varying heights, and their radial angulation fixed by adjustable lock nuts. The one shown is suitable for dogs, puppies, and cats.

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Operation.—The day of operation the animal has no food. Anaesthesia may be induced by either (1) 90 mg./kg. chloralose (warm 1 per cent. aqueous solution) intravenously immediately before operation, preceded by 15 mg. morphine and $\frac{1}{2}$ mg. atropine subcutaneously, or (2) 2 c.c./kg. fresh paraldehyde by stomach tube ninety minutes before operation, the paraldehyde being preceded one-half hour by 30 mg. morphine and 0.6 mg. scopolamine subcutaneously, or by (3) 50 mg./kg. amytal intraperitoneally forty minutes before operation; the anaesthetics are named in order of their preference. The anaesthetized animal is placed on its back on the table, and the lower two rods of the gag, protected by rubber tubing, are placed just back of the canine teeth of the upper and lower jaws; a heavy silk stitch is placed through the tip of the tongue, which is drawn snugly forward and fastened to the upper rod. The animal is gavaged with 0.1 gm./kg. of hexamethylenamine. Mouth is washed with saline cotton, and the entire buccal cavity, pharynx, and gingivæ painted with 1 per cent. aqueous mercurochrome-220; tongue and floor of mouth painted as well with sterile liquid petrolatum. A dressing table is placed as shown in Figure 1, and the mouth is draped with four towels as shown in Figure 2, the corner towel clips conveniently catching the gag rods. The rest of the field is protected with sterile sheets. A gauze sponge damp with saline is placed in the roof of the mouth.

The soft palate is incised its full length, leaving $\frac{1}{2}$ to 1 cm. of its posterior border intact. The posterior palatine arteries are caught for a few moments with hæmostats, but do not ordinarily require ligation. When the incision has first opened into the nasopharynx, it is quickly completed, and a moist cotton pledget with a silk thread attached is placed in the nasopharynx for tamponage at the border of the hard palate, to prevent oozing blood from collecting about the conchæ and giving a post-operative nasal discharge. Guy sutures catching both layers of mucosa are placed midway on either side of the incision for lateral retraction, and fastened to the drappings. Several small bits of palatal muscle are clipped free, and saved on gutta serena tissue for use later in hæmostasis; these should be taken early in the operation before there is possibility of unsterility.

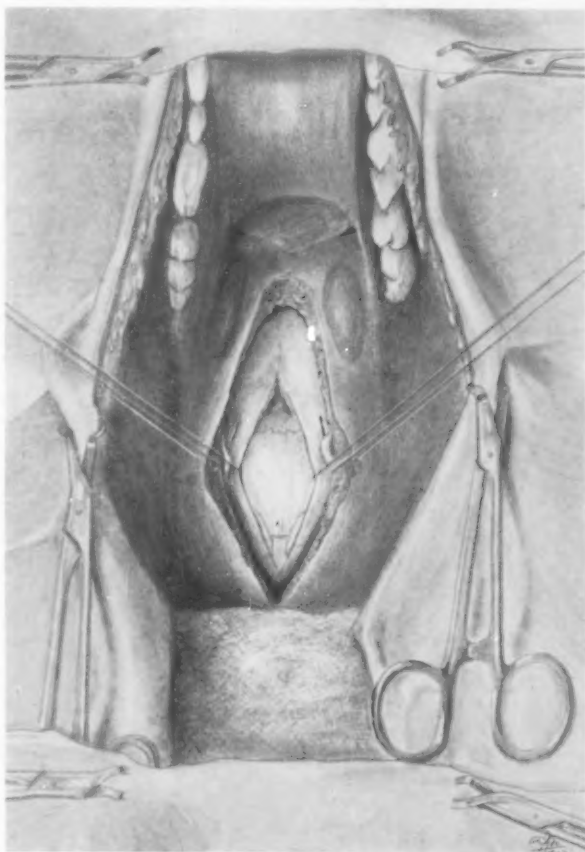


FIG. 2.—Operative field in transbuccal operation. The dog is lying on his back; lower jaw is in upper part of illustration; upper jaw and nose are covered by drapery of lower part of illustrated field. The soft palate has been split and retracted laterally, as has also the nasopharyngeal mucoperiosteum. Tongue, epiglottis, and tonsils are in upper part of illustration. Hard palate is covered with a gauze sponge. The hamulate processes, Eustachian orifices, intersphenoid suture, craniopharyngeal tract emissary vein, and occipitospinosphenoid suture are shown; the nasopharyngeal incision extends posteriorly to the midline dimple which marks the muscles originating from the porous occipitopetrosal ridge. Relations are shown as seen by the operator's oblique view.

The exposed nasopharynx is irrigated with saline (which is removed by suction), and painted with 1 per cent. mercurochrome.

Several landmarks are now in view. (Fig. 2). The hamulate processes of the os

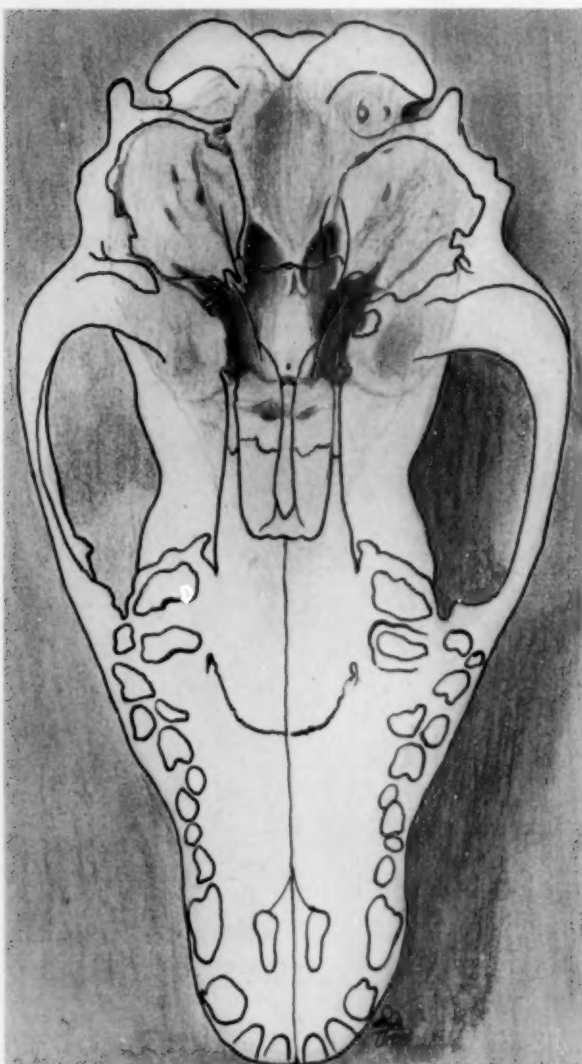


FIG. 3.—Composite view of inferior and superior surfaces of the basilar plate of the canine skull. These relations must be constantly in mind. The inferior (extracranial) surface is shown in outline; the superior (intracranial) surface is in half-tone. Fig. 4 labels important landmarks. Rostrad to the posterior clinoid processes lies a completely avascular area through which the pituitary body may be approached; this area has an abundance of landmarks—the hamulate processes, intersphenoid suture, and cranio-pharyngeal emissary vein mark its anterior border; and the occipito-sphenoid suture its posterior border; laterad to the avascular area are the cavernous venous sinuses which meet underneath the posterior clinoid processes to form the circular sinus. Behind the posterior clinoids are the treacherously variable inferior petrosal sinuses.

as far posteriorly as the stylomastoid tubercle from which the *M. biventer* originates.

A 3 to 4 cm. midline incision is made in the mucoperiosteum, and a periosteal ele-

palatinus are sometimes seen, and are always palpable; beneath them in the operator's view are the slit-like orifices of the Eustachian tubes. In the midline posteriorly is the lambda-shaped dimple which marks the origins of the scalene-rectus capitis groups, and laterally underneath these the unmistakable tympanic bullae are palpable. About 1.5 cm. back of the tympanic bullae the foramen magnum can be palpated. The midline incision in the nasopharyngeal mucoperiosteum is placed with reference to these landmarks. The hamulate processes almost immediately overlie the intersphenoid suture which marks the anterior end of the avascular area of the sella turcica. (Fig. 3.) Just back of the Eustachian orifice is palpable the tympanic bulla's bony spicule protecting the carotid; this almost exactly overlies the occipito-sphenoid suture which marks the base of the posterior clinoid processes; a few millimetres back of this suture also is the crotch of the lambda-shaped dimple mentioned above. The midportion of the porous ridge of the os occipitale from which arise the muscles medially overlying the tympanic bullae marks the cephalic border of the pons and the posterior edge of the treacherously variable inferior petrosal venous sinus running in the dura. (Fig. 5.) This venous sinus sometimes, however, extends

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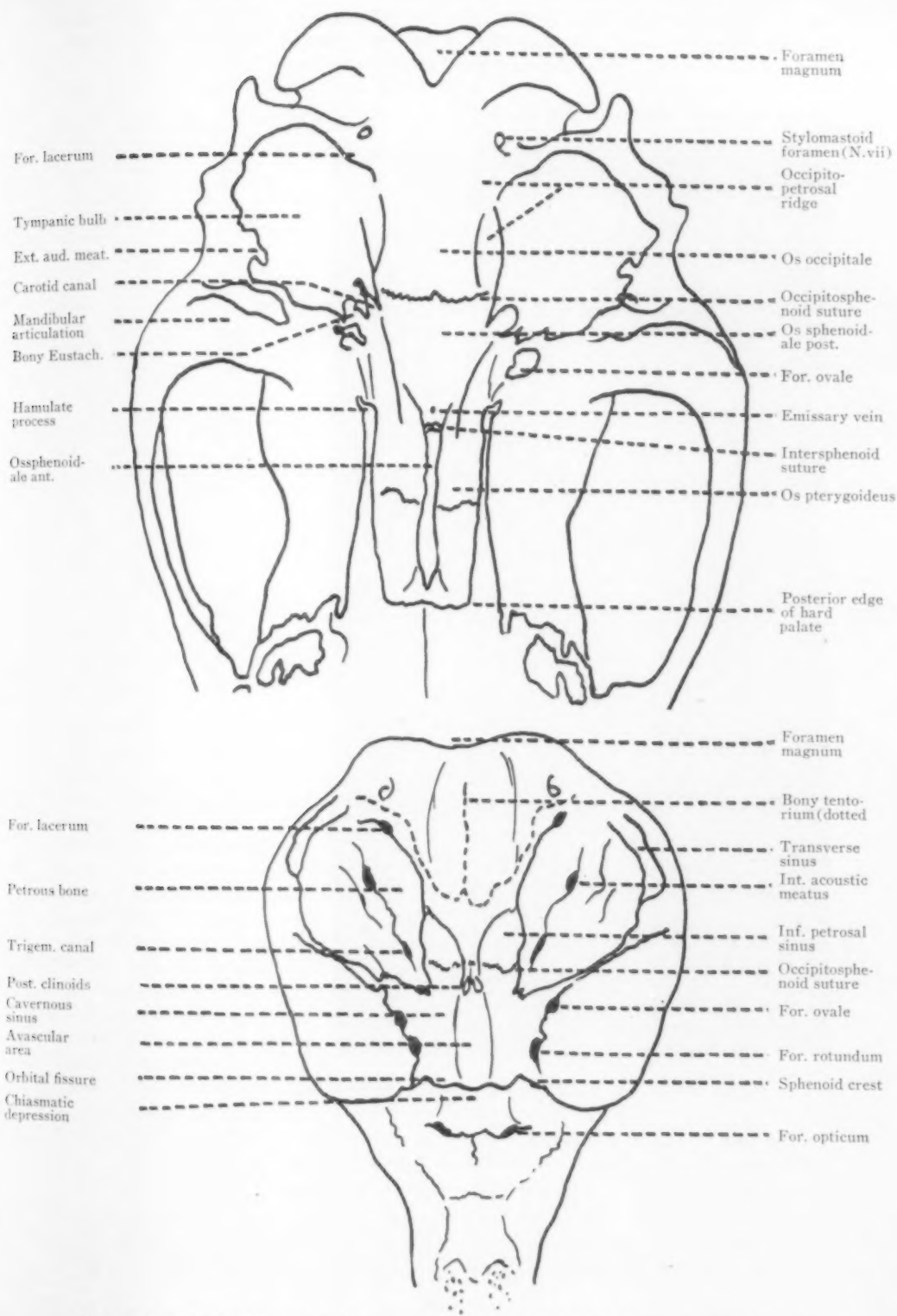


FIG. 4.—Key drawing for Fig. 3. The upper half of the drawing labels structures of the inferior surface of skull, shown in outline in Fig. 3. The lower half of the drawing labels the structures of the superior surface of the basilar plate of the skull, shown in half-tone in Fig. 3.

vator used to free this from underlying bone. On the care with which this is done largely depends the success of the operation; no rent should be made, for this layer must be later sutured back intact, if possibility of meningitis is to be avoided. A second pair of silk guy sutures is placed in the free edges of the mucoperiosteum and gentle adequate lateral retraction obtained. The exposed bone is sluiced with saline. The intersphenoid

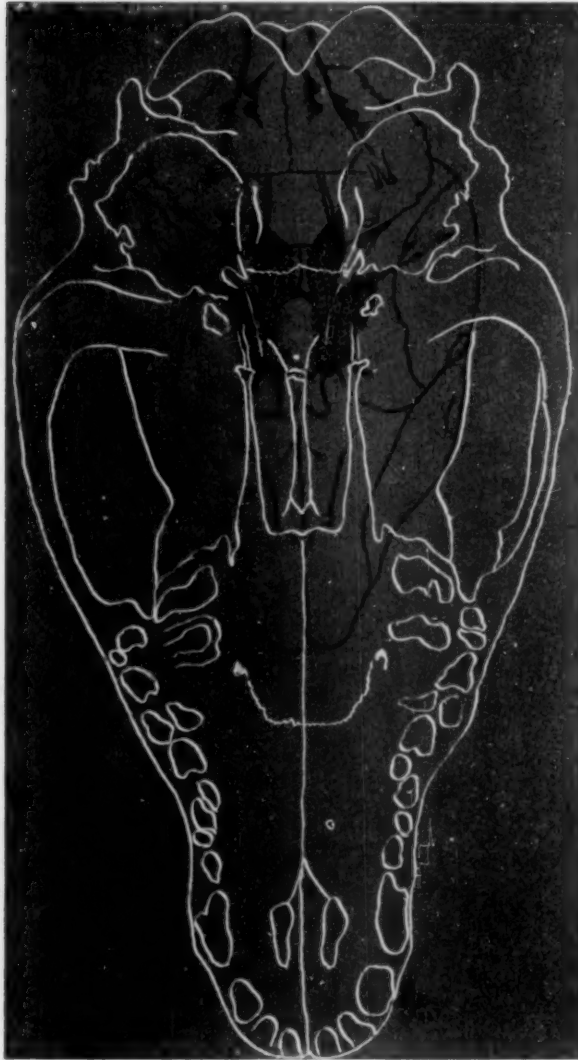


FIG. 5.—Semidiagrammatic view of inferior surface of the canine skull (white), showing location of venous sinuses (stipple), and relations of under surface of the brain (black).

the operator, to afford more working room and a better view. An injured venous sinus may be controlled by packing, suction, and ultimate manœuvring of a piece of muscle over the tear, but prevention is to be preferred to the tedious minutes necessary for this hæmostasis. The field is kept clean by sluicing with saline. Shining dimly through the exposed dura the edges of the venous sinuses can be seen and gross subjacent structure identified.

When hæmostasis is absolute, the dura is opened with dural hook and dural knife.

suture and the occipitosphe-
noid suture are easily seen; between these two, and just back of the intersphenoid suture, lies a small emissary vein from the bone, probably marking the obliterated craniopharyngeal canal; this small persistently oozing point will at first be an excellent landmark, for I have never failed to observe it in any animal operated upon. If the pontine region is to be attacked, the mucoperiosteal incision is more posterior, and the muscles are freed laterally from the porous parabullal ridge.

The basal plate of the skull is attacked with a 3 mm. dental burr, outer table, diploë, and inner table being removed; the intervening plate at the sella is about 4 mm. thick in the average dog; in the midline back of the occipitosphe-
noid suture it is usually only 2.5 mm. thick, but laterally near the bullæ it may be 10–11 mm. thick, and it may be necessary to use gouge and mallet in cleaning out the extreme posterolateral corner. Since the dural venous sinuses immediately underlie the inner table, good control of the burr is necessary. The final paper-thin flakes of inner table may be removed with probe, curette, or forceps. The nasal border of the perforation should be shelved toward

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In hypophysectomies it is well to remember that in the dog and cat the lateral cavernous sinuses do not meet anteriorly, though they do posteriorly, and that therefore the incision should err in length rostrad rather than caudad. The reverse is true for pontine exposures in the neighborhood of the inferior petrosal sinus, as reference to Figures 3 and 5 will show. In making these posterior incisions care should be taken not to injure the basilar artery and its branches, which lie immediately under the dura within the pia-arachnoid. It is frequently necessary to open the arachnoid to identify completely the point of origin of a nerve, for those in the posterior fossa often have a 4 to 10 mm. extramedullary course before becoming invested with arachnoid sheath. The preferred incision in the dura is linear, but if necessary it can be made triangular or stellate. If operative procedures through the dural opening extend beyond thirty to forty-five minutes the danger of meningitis is appreciably increased.

The goal accomplished, the bony defect is packed with a moist mercurochrome pattie which is withdrawn just before the final suture is placed in the mucoperiosteum. The intact mucoperiosteum is closed completely with three interrupted sutures of double-zero plain catgut, using the smallest size ($\frac{1}{8}$ -inch curve) needles. The soft palate is closed in three layers with interrupted sutures of black silk, the nasal tampon being withdrawn just before completion of the first layer. The animal is again gavaged with 0.1 gm./kg. hexamethylenamine, and removed to a warmed, blanketed cage. The

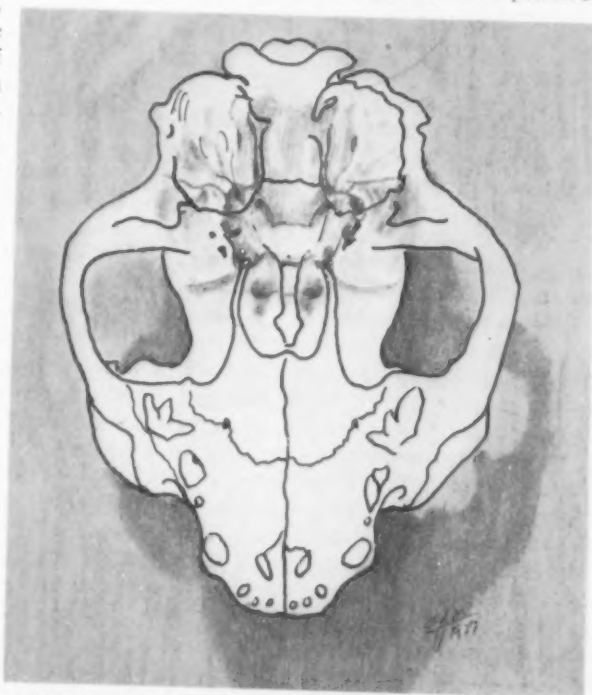


FIG. 6.—Composite view of inferior and superior surfaces of the basilar plate of the feline skull. The inferior (extracranial) surface is shown in outline; the superior (intracranial) surface is in half-tone. In operating these relations must be constantly in mind.

duration of the average transbuccal operation is about two and one-quarter hours, of which probably three-fifths is used for exposure, a fifth for the operation proper, and a fifth for closure.

The points of this operation are (1) an anatomically controlled approach to structures of the base of the brain through a field of potential extreme vascularity (2) conservation and exact reapproximation of the nasopharyngeal mucoperiosteum, which interposes an intact physiological membrane as a bar to infection of the meninges (3) avoidance of post-operative nasal discharge, favoring infection, by light tamponage of choanae (4) anatomical closure of soft palate in layers, conducive to proper healing and thereby avoiding improper swallowing mechanism through dehiscence of the palatal wound, with the danger of late post-operative aspiration pneumonias. It is not good surgical theory to plug the bony defect with dental compound or bone wax; an unintentional illustration of the extent of foreign body reaction which such material may cause is given in the first necropsy report below. Necropsy report of one of the two fatal cases is also given, and finally the findings three months after a successful operation.

CASE I.—Dog D-11; 22 kg. American bull. Transbuccal section of left sixth nerve

2 mm. from pontine origin, December 24, 1926. . . . "As final part of bone plate was being burred away, drill caught in dura at posterior border of opening and made a 1.5 mm. triangular tear in dural wall of inferior petrosal sinus . . . A fair amount of bone wax was placed between the bone and dura posteriorly before relations were clear. When source was discovered, stopped bleeding with muscle, and dug out as much bone wax as possible, but think a fair amount still remains . . ." Uneventful recovery; dog frisky and symptom-free the following day. *Necropsy*, February 12, 1927. . . . "Left crus tightly adherent to petrosal ridge near midline; dissected free carefully. Proved to be largely due to a fibrous foreign-body reaction around a pellet of bone wax. The left inferior petrosal sinus was completely plugged with bone wax, encapsulated by a neo-membrane, and this extended forward on the left to the posterior leg of the circular sinus, where pressure absorption of the cancellous bone had made a deep erosion in the basal plate of the skull, so that only 1.0-1.5 mm. of porous bone remained above the nasopharyngeal mucosa; this was about five or six mm. diameter, and was at first taken for a misplaced operative bony opening, but lateral dissections behind the petrosal ridge showed the operative bony defect almost completely closed and reossified except for a small smooth-edged opening about 2 mm. diameter (original opening 10 x 6 mm.)" . . .

CASE II.—Dog D-12; 13 kg. Collie. Transbuccal section of left sixth nerve, November 30, 1926; post-operative meningitis. . . . "Opening was placed too far anteriorly, and on attempting to open dura, the petrosal sinus was encountered repeatedly; hæmostasis quite difficult, but maintained. After two and three-quarter hours a bit of bone was taken with straight rongeurs, more posteriorly and laterally, undermining the stylomastoid tubercle. Dural incision was made here and ultimately proved to be over the left middle of the pons, not as far laterally as usual. On depressing the brainstem to the right, the sixth nerve was seen. A long right-angled dural hook knife was inserted under it in an attempt made to cut it with right-angled scissors, which failed. The nerve was therefore partially cut through and partially avulsed with dural hook knife . . . Nasopharyngeal mucoperiosteum closed intact except for 1.5 mm. tear on left anteriorly . . . Duration four and one-half hours." The muscle used for hæmostasis was biventer, taken about one and one-half hours after incision of the mucoperiosteum. The dog recovered from anæsthetic, was erratic, thirsty, and later vomited; eighteen hours after operation it became unconscious, head retracted, neck stiff, legs straight out, had Biot's breathing with hypernœa; exitus four hours later. *Necropsy*, December 2, 1926. . . . "Nasopharyngeal mucosa over occipital bone has stitches intact, good approximation; a few small plaques of fibrin 2 x 3/4 mm. in size are over the incision. On removing stitches a small amount of thin slightly glairy turbid fluid is found in bony operative defect, and a 2 mm. fungus cerebri . . . When calvarium, hemispheres, and cerebellum are removed, a thin sheet of clot is found about and below the cerebellum at the right side of the incisura tentorii, extending caudad down to vagal roots, across ventral aspect of medulla, and a short distance anteriorly on the left . . . The surface of the cerebrum is slightly reddened and there are a few whitish streaks under the pia in the frontal sagittal convolutions; the pia is everywhere slightly injected; and the cerebrospinal fluid in the lateral ventricles is slightly turbid . . ."

CASE III.—Dog E-7; 26 kg. Dane mongrel. Transbuccal hypophysectomy. May 4, 1927. . . . "Suture between anterior and posterior ossa sphenoida easily identified; a 4 mm. opening just posterior to this drilled in midline; edges of opening made perpendicular with small curette . . . Circular sinus seen in left lateral border and avoided. Dural base of sella incised stellately with right angled dural hook knife. Anterior lobe pouted into defect and was removed in two bites with curette forceps; no bleeding; sucker constantly; moderate amount of cerebrospinal fluid. Posterior hypophysial lobe seen still attached posteriorly, and was curetted out piecemeal; tenaciously adherent at dural attachment near clinoids. Sella seen by direct inspection to be entirely dry and empty. Probably 2 to 3 c.c. blood lost in removal." Dog used repeatedly for tiration of oxytocic substance in blood dialysate. *Necropsy*, August 10, 1927. The peri-infundibular

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region was loosely adherent to the dura by filmy wisps; the dura was "adherent deeply into the pit of the healed bony operative excavation . . ." which was "so firm that a probe could not pierce it, with considerable force."

SUMMARY

A description of a relatively avascular experimental transbuccal approach to the base of the brain of carnivora is given, which necessarily avoids damage to contiguous neurological structures, and which has a considerably lower mortality rate than any procedure heretofore described approaching this region (Aschner, 29 per cent.; Dandy and Reichert, 16 per cent.; present operation, 11 per cent., the final twelve operations of this series having negligible morbidity and being without a single fatality).

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PLASTIC SURGERY ABOUT THE EYES *

By ADALBERT G. BETTMAN, M.D.

OF PORTLAND, ORE.

THIS paper is intended to present several types of conditions occurring about the eye which may be treated by the general surgeon. This paper is further circumscribed in that it does not pretend to be a consideration of all the many and varied conditions it might be made to include.

Not an inconsiderable proportion of surgery about the eye consists of removing conspicuous scars and replacing them with minimum scars. (Figs. 1, 2 and 3.) All scar tissue must be excised widely until good skin edges can be brought together without tension and in slight eversion, undercutting the edges when necessary. Having carried out the proper technic, the minimum scar will result. What the minimum scar for any particular patient is, then depends on the healing powers of that patient.

In all plastic surgery, and in fact in all surgery, the tissues must be treated kindly. Traumatism of the edges which are to be brought together make impossible the obtaining of the minimum scar. I have found it unnecessary to use forceps of any kind on tissue which is to be left in any operation, except to pick up vessels.

When the edges of wounds are crushed with hæmostats or are picked up, with tissue forceps, mouse-toothed or otherwise, there results a definite injury. Every scar is the tombstone of an injury, therefore the necessity of avoiding even slight traumatisms and developing a technic which will put this into practice.

When it is necessary to pull tissues about it had best be done from the under-surface with sharp hooks. When these are insufficient, pierce the tissue back from the edge with a fine-pointed instrument, as a hook or towel-clamp, rather than apply crushing instruments.

The next most important principle in plastic surgery, second only to treat the tissues kindly, is, do not merely approximate wound edges, bring them into exact apposition. In the approximation of wound edges they are brought together approximately, nearly, but when the edges are brought into exact apposition, they are placed in the best possible position for healing. Every surgeon has noticed that portions of wounds heal quicker and with nicer scars than other parts of the same wounds. The edges which heal most rapidly and which produce the least scar are those which have been placed in exact apposition. With the edges in exact apposition there are no gaps to be bridged and the minimum scar formation is required to hold the edges together. Wound edges can be held in exact apposition by the careful placing of the necessary number of sutures. Use suture material and needles as fine

* Read before the King County Medical Society, Seattle, Wash., March 19, 1928.

PLASTIC SURGERY ABOUT THE EYES



FIG. 1.—A scar resulting from healing of a wound without the underlying tissues being brought together.



FIG. 2.—A scar extending from the forehead down the face to under the chin. Excised and resutured, giving an invisible scar.



FIG. 3.—The result of a dynamite explosion. Skin deformity requires correction and the eyelids and eye-socket must also be rebuilt.



FIG. 4.—Shows result of the absorption of fat from about the upper and lower lids following loss of an eye. Corrected by transplantation of fat from thigh.

as the nature of the work will allow. The needle should be inserted at a right angle to the surface so as to produce a minimum destruction of cells. Bring the skin edges together to appose, not only the skin itself, but the tissues directly underlying.

There must never be tension on the stitches holding the edges together. Tension must be relieved. This may be done by uniting the subcutaneous tissues with catgut, or by figure-of-eight sutures of horsehair so that the deeper loop brings the edges together.

It is often necessary to relieve tension by placing deep mattress sutures of silkworm gut beyond the line of union. These may be tied over buttons inverted. When buttons are applied in the ordinary manner the maximum pressure occurs in the area directly surrounding the suture, but when properly selected buttons are applied, upside down, this is not the case. The buttons used are the ordinary bone underwear buttons, free from sharp edges, and having a depression immediately surrounding and including the stitch-holes. When these are applied in this manner the maximum pressure is at a little distance from the stitch-holes. There really occurs a protrusion about the stitches so that when the sutures are removed the conical projections retract to the level of the surrounding skin. It is not necessary to tie tension sutures real tight. They should be tight enough to just relieve the tension.

It should be the aim to produce in every surgical procedure not only a minimum scar, but an artistically healed wound. It is surprising how small the scars may be made and how difficult they may be to find when the technic gives due consideration to the various points involved. During healing wounds must be held quiet, for otherwise the pulling and movement of the edges on each other will produce larger scars. Keloids are the result of tension on the wound edges, plus movement, plus the healing powers of the patient. The formation of these disfiguring scars may be minimized by attention to proper details. While scars are usually invisible no patient should be told that they will not be the one to have a larger scar, due to conditions within the patient himself.

An otherwise nice-appearing scar may be disfigured by cross-marks, the result of leaving sutures in too long. Sutures are placed for the purpose of holding the tissues together until healing has taken place, and as soon as this is accomplished, they had better be removed carefully. In a recent paper the author discussed the production of the minimum scar in detail.†

Practically all operations in plastic surgery may be performed under local anæsthesia, using usually one per cent. procaine (novocaine) with five minims adrenalin solution per ounce. The youngest patient on whom I have used it was a girl of four years, and the oldest, a man of eighty. Talking to patients more or less continuously during all operative procedures and encour-

† The Minimum Scar. Bettman, A. G., Medical Sentinel, Portland, Oregon, April, 1926.

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FIG. 5.—Condition when I saw him after he had undergone many operations elsewhere. Scar below eye replaced by Wolf graft. Scar at outer canthus excised and palpebral fissure made smaller.



FIG. 6.—Notches in upper lid corrected. Tissue excised within orbit to overcome ectropion. Portion of temporal muscle grafted into lower lid to give motion. Lower eyelid thinned. All work done on lids through old scars.



FIG. 7.—Disfiguring wrinkles on lower eyelids.



FIG. 8.—Wrinkles removed by excision. Scars invisible.

aging them to reply allays their fears and gains their coöperation. Occasionally a patient drops off to sleep during the operation.

Thirty minutes previous to the beginning of the operation, the patient is given a hypodermic of one-sixth or one-fourth grain of morphine and one-one hundred and fiftieth grain of atropine, and by mouth one and one-half grains isoamylethyl barbituric acid (amytal). The amytal is given because less anæsthetic is required and the patient is not nervous, but most important of all is the property the barbitals possess of blocking the toxic effects of the local anæsthetic; also amytal acts very quickly.

Having assured the patient that the operation will be done painlessly always announce before the needle is inserted the first time that it will be felt else the confidence of the patient may be lost.

The loss of an eye, with its unfortunate deformities, is a serious handicap to any patient. When an eye is lost as the result of disease or injury, there may or may not be injury to the surrounding soft parts. (Fig. 3.) When an eye must be sacrificed it is important, in order to obtain a subsequent good appearance in the wearing of an artificial eye, that the muscles be properly taken care of. They must be sutured to those which are opposite to them, anatomically and functionally, across the wound and not to those adjacent. The internal rectus must be sutured to the external rectus, and the superior rectus to the inferior rectus, irrespective to the type of operation otherwise. It is only when this is done that the maximum amount of mobility of the artificial eye is obtained. Care should also be taken to provide a sufficiently large cavity with depth and height enough to hold the prothesis in position.

As the result of the loss of an eye through injury, it may happen that there has been destruction of large amounts of mucous membrane and other tissues or that the mucous membrane is so lacerated that when healing has taken place, the cavity is either too small to hold an artificial eye or is badly shaped. (Figs. 4, 5.) In the primary suturing of such an eye socket, it is necessary to bring the edges accurately together, for here, as elsewhere, surfaces not covered by epithelium heal by scar formation and contractures. When a contracted socket is present it is necessary that it be reconstructed. In reconditioning a socket, the tissues underlying the mucous membrane usually must be removed over a wide area, superiorly, inferiorly and laterally, and the mucous membrane carefully sutured. However, this may not be sufficient, for, if allowed to heal thus, the original inadequate cavity may recur. To prevent such an unfortunate result, hold the mucous membrane up and down and out against the depths of the socket. This is accomplished by a very simple method. Having prepared the cavity and sutured the mucous membrane to give the maximum relaxation, a piece of dental modelling wax is molded to fit the cavity and being sure that it fits well into the recesses, the eyelids are sutured together over it. This model, in addition to forcing the mucous membrane against the walls of the cavity, allows the eyelids to be held in an over-corrected position until healing has taken place.

It sometimes happens that there is not available sufficient mucous mem-

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FIG. 9.—Shallow deformed eye-socket.

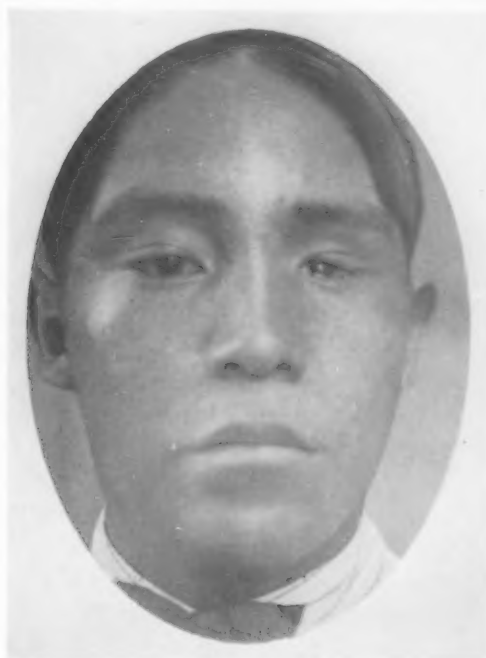


FIG. 10.—Artificial eye in place. The œdema of the lids had not entirely subsided when picture was taken.



FIG. 11.—Heavy disfiguring pouches under eyes.



FIG. 12.—After excision of crescent-shaped piece of skin from lower lids.

brane to line the proper-sized socket. It is then necessary to provide epithelial lining for that portion which is deficient. This may be done by means of a Thiersch graft, laid over and held in place by a model of dental wax, a stent. In cutting such a graft a suitable razor is imperative.‡

There is no reason why mucous membrane obtained from the prepuce cannot be used to supply such a deficiency. The writer has not had an opportunity to use this source of supply for this purpose, but has used it to stent-graft mucous membrane into the mouth to restore the sulcus between the lower lip and the inferior maxilla below the teeth with an excellent result.

A deformity which produces more mental effect than it seems to warrant and which is present in so many patients who have suffered the loss of an eye, is the absorption of the supra- and infra-orbital fat. (Fig. 4.) Patients seem to have a greater aversion for this hollow-eyed, cadaverous appearance than for many other major defects. This unsightly condition can be corrected by the transplantation of fat from either the abdomen or upper part of the thigh. I have used both but prefer that over the fascia lata, as it is firmer, readily obtained, and the resulting scar cannot be mistaken for evidence of a previous abdominal operation.

Incise the skin away from the position that the fat is to occupy and with a long-bladed, narrow, rather small scissors, make a tunnel that maps out the entire area to be filled. A piece of fat is prepared of such size that when placed in position the defect will be somewhat over-corrected. The wound free from oozing, is closed carefully and a pressure dressing applied. After healing has taken place, there is absorption of a portion of the fat, usually about one-third, which fact must be taken into consideration. Fat may also be used to fill defects in the frontal region, resulting from operations on the frontal sinuses or from loss of tissue through trauma or otherwise.

Transplanting a muscle to give motion to a paralyzed or muscleless eyelid is an interesting procedure. The temporal muscle is used, detaching above a strip one-fourth inch wide, leaving it attached below and suturing the free end to the eyelid, after passing it through a subcutaneous tunnel.

Wrinkles, bags and folds, the superabundance of skin of the upper and lower eyelids, which give the appearance of age, or worse, of premature age (Figs. 7, 8, 11 and 12) may require attention. Such evidences of increasing age, of course, do not make their appearance suddenly, yet there comes a time when the realization of the disfigurement is brought home to the patient in such a way that the removal of the circumstantial evidence of beginning antiquity is desired. It is necessary often to correct also the appearance of the face, neck and chin in order to brush back the heavy hand of time.

The desire to have wrinkles about the eyes removed, alone, without giving consideration to the rest of the face, in my experience, has been more fre-

‡ A New Thiersch Graft Razor. Bettman, A. G., Jour. A. M. A., Chicago, Aug. 6, 1927, vol. lxxxix, p. 451.

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FIG. 13.—Photograph of wax model. Loss of eye, ectropion of lower lid, and loss of portion of nasal bones. Shot for a deer.



FIG. 14.—Condition following correction of eyelid and nasal deformities. Prosthesis in place.



FIG. 15.—Fell in fireplace when one year old, now over sixteen.



FIG. 16.—Condition of eyelid after pad of gauze had held it up a few days. Lips after first operation.

quently requested by men than by women. Women give concern to the face and neck first. It seems as though the wrinkles and lines about the face of a man produce less psychological reaction than do those about the eyes. I have noted also that men are more jealous of the secret that they have had these corrugations of age removed than are women. The operation is frequently done on men the first day of their vacations. Healing has taken place usually by the fourth day. Add ten days more for vacation, and he returns to his associates, remarkably younger looking. The credit for his rested-up, more youthful and better appearance being given to the wonderful sea breezes or invigorating mountain air, as the case may be. The scars are so small as to be imperceptible.

When a patient applies for relief of baggy eyelids with wrinkles and overfullness the surgeon must fix in his mind the exact condition to be corrected. How much tissue to remove is always an interesting problem.

The operation will now be described, no consideration being given to conditions which may, or may not, have been corrected in other parts of the face.

With a pair of scissors, curved on the flap, and which cut perfectly, or with a very sharp knife, preferably of the replaceable blade type, the desired amount of tissue is removed. When the knife is used the crescent-shaped area of skin is outlined with it and excised. I prefer the scissors.

Note the amount of skin to be removed by picking up the lid covering, when the eyes are gently closed. The skin well within this area is grasped by tissue forceps and pulled away from the lid. Then with the scissors, the skin included in the forceps is cut away. When too little has been removed it is a simple matter to enlarge the excision. Sufficient should be cut away so that when healing has taken place the closed lid will have just enough tension that had any more been removed it would have been too much. The excision having been completed very fine horsehair on small needles is used for interrupted sutures. The stitches are inserted quite near the edges of the wound, care being taken here as elsewhere to bring the edges into exact apposition.

Oftentimes, in order to produce the maximum benefit, it is necessary to extend either the upper or the lower incision, depending upon the condition, beyond the outer angle of the eye toward the temple and excise there an ellipse of skin of such length and breadth that the so-called crows-feet are removed.

Removal of the right amount of skin, the careful suturing of the wound edges producing invisible scars, and the resulting absence of the wrinkled and otherwise disfiguring eyelids, leaves the normal fullness of the eye skin. Of course, it is necessary not only to carry out the same procedure on the opposite side but to carry it out to the same extent. No dressings are used. Some of the stitches are usually taken out after twenty-four hours, and in most cases all but the centre one after forty-eight hours; this last being removed the following day. There is little or no redness, the amount

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of scar is very small, and the patient appreciates the change in appearance. Oftentimes only the upper or only the lower lids require correction.

The surgical removal of those yellowish, disfiguring areas, xanthoma, is accomplished in this same way, making such modifications in the technic as the condition indicates. These may also be removed with saturated solution of trichloroacetic acid, but healing is very much slower, a matter of weeks instead of days.

In suturing wounds of the soft structures about the eyes it should be the aim to restore the tissues as accurately as possible to their original positions, using a sufficient number of sutures carefully applied to accomplish this purpose. Many times following the healing of such a wound it will be found that the upper cheek tissue is divided by the scar, producing a very disfiguring effect. This might have been obviated, had the deeper tissues been sutured as well as the skin. In lacerations extending into the subcutaneous tissues, it is necessary to bring these tissues together also. Fine catgut may be used, but this is usually unnecessary when deeper structures are not involved, if the horsehair is inserted as figure-of-eight stitches. This stitch is a little slower to place but brings the underlying tissue and the skin together often before the knot is tied.

In cases where there has been infection there is more likely to result a pouching effect which is due to the shutting off of the lymphatic drainage by the scar. This drainage may be reestablished by excising the scar septum, suturing carefully and placing two or more silk threads, impregnated with Bipp, so that they extend from well above the septum to well below it. They are cut off close to the surface and their ends made to retract well below the full thickness of the skin at both ends.

This method was carried out for a young man who had a very disfiguring lesion of this type. The scar was excised, the wound carefully sutured, and the silk inserted. After several months the threads worked toward the surface at their lower extremities and were removed, but the amount of scar is so small and the pouching has so far disappeared that today an observer would have to search for the one and would not be able to find the other. This man had other conditions which complicated the case and which were all corrected to his entire satisfaction.

It is perhaps rare for a patient who has received a serious injury about the eye to present himself with only one surgical problem. Usually there are at least scars to be removed in addition to the other deformities. Multiple lesions are the rule following cutting injuries about the eye.

No rule can be laid down applicable for the correction of all cases of ectropion and entropion. Many of these conditions are difficult to handle. When there is loss of the eye the eyelid condition often can be corrected at the time the socket is repaired. (Figs. 13 and 14.) Moderate ectropion may be corrected by suturing a "V" of the skin as a "Y", or by excision and suture. This gives very good results in the small percentage of cases to which it is applicable, the scar being negligible. Shortening the mucous

membrane surface may be indicated. Sometimes the shortening of the lid margin by excising a "V" the full thickness of the lid will give the result. There are many and varied operations recommended, each applicable to a particular defect, and designed by the originating surgeon for the case at hand.

When the tissues are insufficient to allow the lid to be raised it is necessary to transplant skin from the other lid of the same side, or from the temple or elsewhere. This may also be necessary following the removal of disfiguring moles, birthmarks, epitheliomas, and other lesions. On occasions entire eyelids must be provided.

When ectropion is so marked that sufficient tissue cannot be readily obtained by the means just mentioned, another method must be used. The case of a young woman will be described. When one year old this girl fell into the fireplace while strapped in a high-chair. Her face was badly burned. Probably the most disfiguring conditions about the eyes are the result of burns. (Figs. 15 and 16.)

In the following case an unsuccessful attempt at correction had been made by another surgeon previous to my seeing her. When I saw her she was past sixteen years of age. Her lower left eyelid was in extreme ectropion. By extreme is meant that the lid was pulled down on the face as far as was possible, the entire mucous membrane being exposed, the ciliated edge lying on the cheek an inch and a quarter below its normal position and firmly held there. The mucous membrane was the seat of a chronic inflammation. The front of the eye was exposed. The skin of the cheek below the attachment of the eyelid was pulled up and was badly scarred. In addition the left halves of both lips were inside the mouth and held there by contracted scars. The problem regarding the lid was to raise it to its normal position and keep it there. Skin was supplied by means of a full thickness graft held in place by a stent.

An incision was made through the scar of the cheek below the lid margin, removing all scar tissue, and freeing the lid over its entirety. The lid was then held in the position which it occupied before the beginning of the operation and a model of the cavity thus formed was made of dental modelling wax. From the skin of the inner side of the arm, a section was cut of such size that it would entirely cover the model. This graft which included the full thickness of skin, devoid of all fat, was applied to the model, surface side against the wax, and enough sutures placed in its open sides to prevent the model slipping out. The model, thus covered by skin which was drawn taut, was placed in the cavity between the eyelid and the cheek and sutured in place, care being taken to fit it well up against the lower fornix.

A suture was passed through the skin of the lower lid, through both layers of skin of the graft, through the lower layer of wound and tied. Such stitches were continued across the entire length of the wound and the original sutures removed. At the end of the operation, due to the presence of the skin-covered model, the eyelid was a little fuller than before.

On the ninth day the stitches were carefully removed. The eyelid was now free, covered by its mucous membrane above and by skin below; which skin extended down on the cheek. The graft had taken perfectly. The eyelid was then raised up against the eye-ball and a pad of gauze applied. Later some adjustments were necessary, due to the long years of stretching having made the lid margin too long to hug the eye-ball as it normally should. The result was very pleasing to the young lady and the smile on her face indicated the change, not only in her face, but in her mental attitude.

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The skin of the eyelids is different from that of other parts of the body, in that it is very thin. The only skin of a similar type is on the prepuce, which source of supply might be used to good advantage to fill deficiencies of the eyelid.

Interesting operations are those of restoring the loss of eyebrows and eyelashes. An eyebrow may be restored by transplanting a portion of the remaining brow or a portion of the opposite one, or by means of a free or pedicled graft of hair-bearing skin from the scalp, care being taken to see that the hair will be turned in the proper direction.

Tattooing eyelashes will not take the place of transplanting hair-bearing skin but is useful where the lashes are few and far apart.

To make the eyes larger, canthoplasty, the incision is made from the outer canthus, outwardly, and the edges of the skin and mucous membrane on each side of the incision are sutured accurately together. A very small incision, one-sixteenth to one-tenth inch, enlarges the palpebral slit quite enough.

A condition which is very difficult to restore is that of the distortion of the inner canthus. This is due chiefly to the fact that in this region the tissues are quite loosely attached to the surrounding osseous structures. When the entire inner canthus is too low or when the inner end of the lower lid is too low, the effect is bad. There are a number of methods for making this correction, but a good result is difficult to obtain. It seems to be one of those little things that require strategic handling. The best result in some cases is accomplished by making a linear incision or an ellipse is excised at the nasal side of the canthus of the proper length and location, and sutured so as to bring the opposite ends of the wound together, placing the sutures deeply above to bring the lower angle up.

Contractions following burns may cause deformity closing the lids which will require an entirely different method of treatment.

When two years old, L. W. was burned by falling so that his eyelid came in contact with a hot stove-door handle. The burn extended from well up on the superior lid to almost the lower border of the ala. The cornea was seared, the inner half of the pupil was opaque, and he had developed compensatory strabismus. The contraction of the skin scar pulled the upper lid down, uniting it to the lower lid and drawing the distorted inner canthus outwardly. The lids were pulled a considerable distance away from the eyeball at the inner canthus. The boy was at this time six years old. He had a distorted appearance and was beginning to realize his deformity. He was unable to see with the impaired eye because of the position of the lids. The first operation removed the scar from the inner canthus down along the nose. He was now able to see, the lids being out of the line of vision. At the second operation scar was removed to a considerable depth and the lids sutured close up against the eyeball. The boy's condition at this time was quite good except that the distance from the nose to the inner canthus was still somewhat greater than on the other side. The inner canthus was later brought nearer its normal position.

Patients appear not infrequently for the removal of disfiguring masses of paraffin from about the eyes. The simplicity of injecting paraffin makes it

appeal to those who are not properly qualified for other types of work. The immediate result is very good and the patient is satisfied, but after a number of years connective tissue growth is stimulated and the mass enlarges, producing great disfigurement.

This does not happen, fortunately, in every case but is sufficiently frequent to make its use unjustifiable. In addition to the masses appearing in unnatural places the skin over the injection often becomes red.

The removal of paraffin is a difficult procedure. The patient expects that the operated area will be smooth and devoid of irregularities. This usually can be accomplished but no surgeon would make such a promise to a patient.

Although it has not been mentioned specifically you have noted that many cases have required repeated operations for the production of the maximum correction. To attempt the complete operation at one step would not give the best result. It is better to attempt one step and accomplish it than to try too much and not be successful. Stage operations produce results not attainable otherwise and many steps may be required. Under local anaesthesia this can be accomplished.

CANCER OF THE TONGUE AND FLOOR OF THE MOUTH *

BY GEORGE M. DORRANCE, M.D.

AND

JAMES K. McSHANE, M.D.

OF PHILADELPHIA, PA.

WE ARE presenting an analysis of the 164 cases of carcinoma of the tongue and floor of the mouth, who were treated on our Service at the Radiologic Department of the Philadelphia General Hospital from 1922 to 1928.

When we consider the incidence of carcinoma of the tongue and floor of the mouth according to race, sex and age, we find there were eleven negroes or 7.9 per cent.; and seven females or 4.2 per cent.

The youngest patient was twenty-eight years of age and the oldest was eighty-six years. Grouped in ten year classes, we have the following:

Between the ages of 20 and 30 there was	1 or	.6%
Between the ages of 30 and 40 there were	2 or	1.2%
Between the ages of 40 and 50 there were	22 or	13.4%
Between the ages of 50 and 60 there were	51 or	31%
Between the ages of 60 and 70 there were	51 or	31%
Between the ages of 70 and 80 there were	21 or	12.8%
Between the ages of 80 and 86 there were	2 or	1.2%
Undetermined there were	14 or	9.4%

It is to be noted that the ages from fifty to seventy includes 62 per cent. of the patients.

In studying the duration of the disease in our series from onset to death, we notice very vast differences. It was very evident from examination that some of these patients had been suffering from malignancy of the mouth for a long time before they were aware of the fact that any abnormalities existed, as they were in an advanced stage before consulting a physician. Some gave a history of conditions extending over many years which were probably pre-cancerous lesions and had degenerated into cancer.

There were 48 cases who lived less than 1 year.
There were 39 cases who lived from 1 to 1½ years.
There were 7 cases who lived under 2 years.
There were 8 cases who lived under 3 years.
There were 6 cases who lived under 4 years.
There was 1 case who lived under 5 years.
There were 2 cases who lived under 6 years.
There was 1 case who lived under 7 years.
There were 2 cases who lived under 8 years.
There was 1 case who lived under 12 years.
There was 1 case who lived under 16 years.
There were 48 cases who lived duration not determined.

* Read before the Philadelphia Academy of Surgery, May 14, 1928.

It is very striking that 53 per cent. of the total number of cases and 75 per cent. of the number in which the duration could be determined from the history lived less than one and one-half years irrespective of the type of treatment they received.

It would seem that the natural history of cancer of the tongue and floor of the mouth is one of short duration.

A history of treatment prior to admission to the Philadelphia General Hospital was elicited from seventy-eight or 47.5 per cent. of the patients.

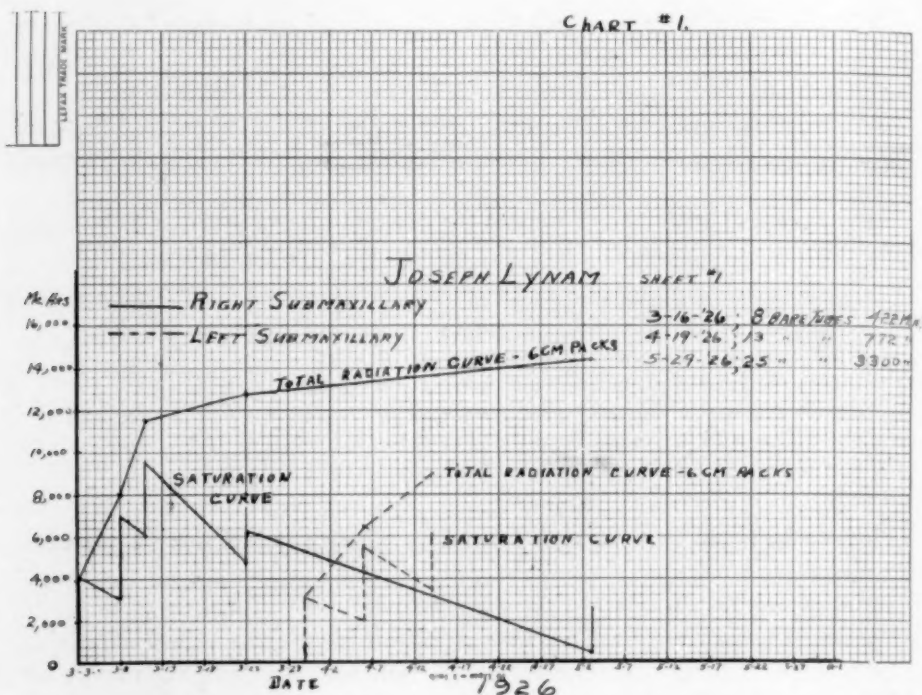


CHART 1.—J. L., age sixty-six years, admitted February 16, 1926, died April 20, 1927. Lived one year and two months. Prickle-cell carcinoma of the tongue. Figures in upper right hand corner show the treatment of local lesion with bare tubes. In the total radiation curve, it will be seen that from March 3, 1926, to May 3, 1926, 14,400 millicurie hours of radiation was given to the right submaxillary region. During the period from March 30 to April 14, 8,800 millicurie hours were given to the left submaxillary region. The saturation curves show the amount of radiation in the tissue at any given time.

Practically every large hospital in Philadelphia and a few in neighboring cities are represented in this list.

In our routine study of these cases, the Wassermann test was done in 112 cases. It was negative in seventy-four and positive in twenty-eight cases. The patients with concomitant syphilis ran a shorter course and their disease seemed more virulent than those with a negative Wassermann, when judged by the history of the duration of their disease.

The average length of life for this group from the onset of the cancer to their deaths was 14.5 months.

It has been our practice to disregard syphilis when treating malignancy of the mouth—to treat the latter and not the former. We have the impres-

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sion that treating the syphilis makes the patient worse and these patients do not do well. There are of course exceptions, where there is a question of diagnosis, the pathological report of the biopsy being chronic inflammatory tissue and the lesion being atypical of carcinoma. The therapeutic test of specific treatment is instituted until the diagnosis is proven to be cancer or syphilis.

Biopsy or tissue examination from operative specimens was made in seventy-one of the patients. This low incidence is due to the fact that many

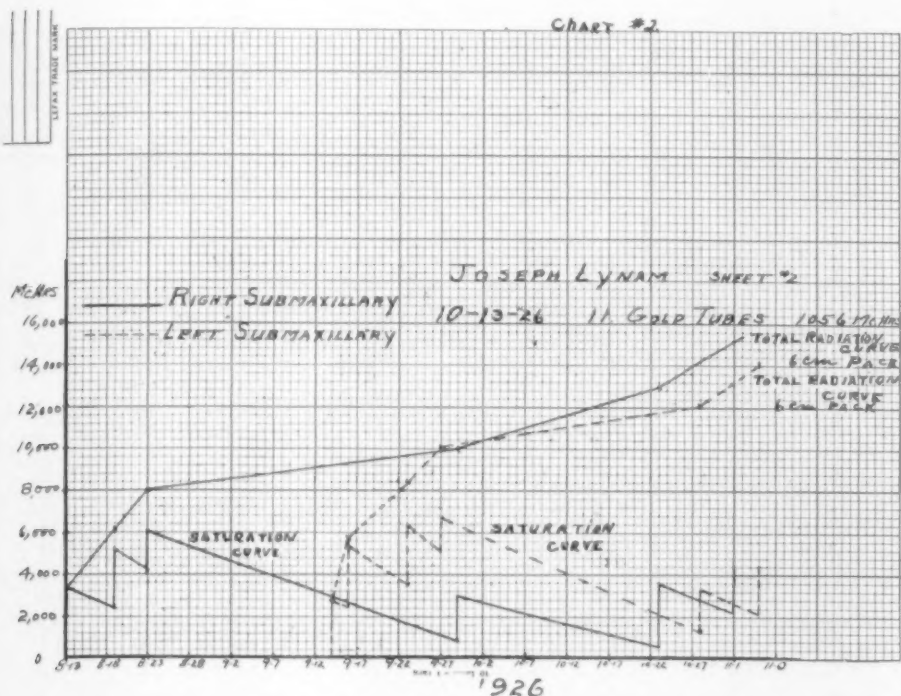


CHART 2 is a continuation of Case I. It is to be noted that no radiation was given from May 3 to August 3. During the period from August 3 to November 2, 1926, 15,200 millicurie hours were given to the right submaxillary region. During the period from September 14 to November 4, 14,000 millicurie hours were given to the left submaxillary region. Gold tubes were implanted in the local lesion on October 13, 1926, amounting to 1,050 millicurie hours.

of these cases were in a hopeless and dying condition when first referred to the Philadelphia General Hospital. We did not feel justified in taking biopsies from these patients as the diagnosis clinically was self-evident and they were too far advanced for any treatment.

It is our strict rule, however, that all patients whom we treat must have one or more biopsies until the diagnosis is proven. We would like to emphasize the necessity of a pathological confirmation of the diagnosis of cancer in every patient before he is treated.

In a certain number of cases we were unable to prove the diagnosis of cancer and these gave us our most brilliant results. They are not included in this series for that reason. We have had quite a number of cases sent to us

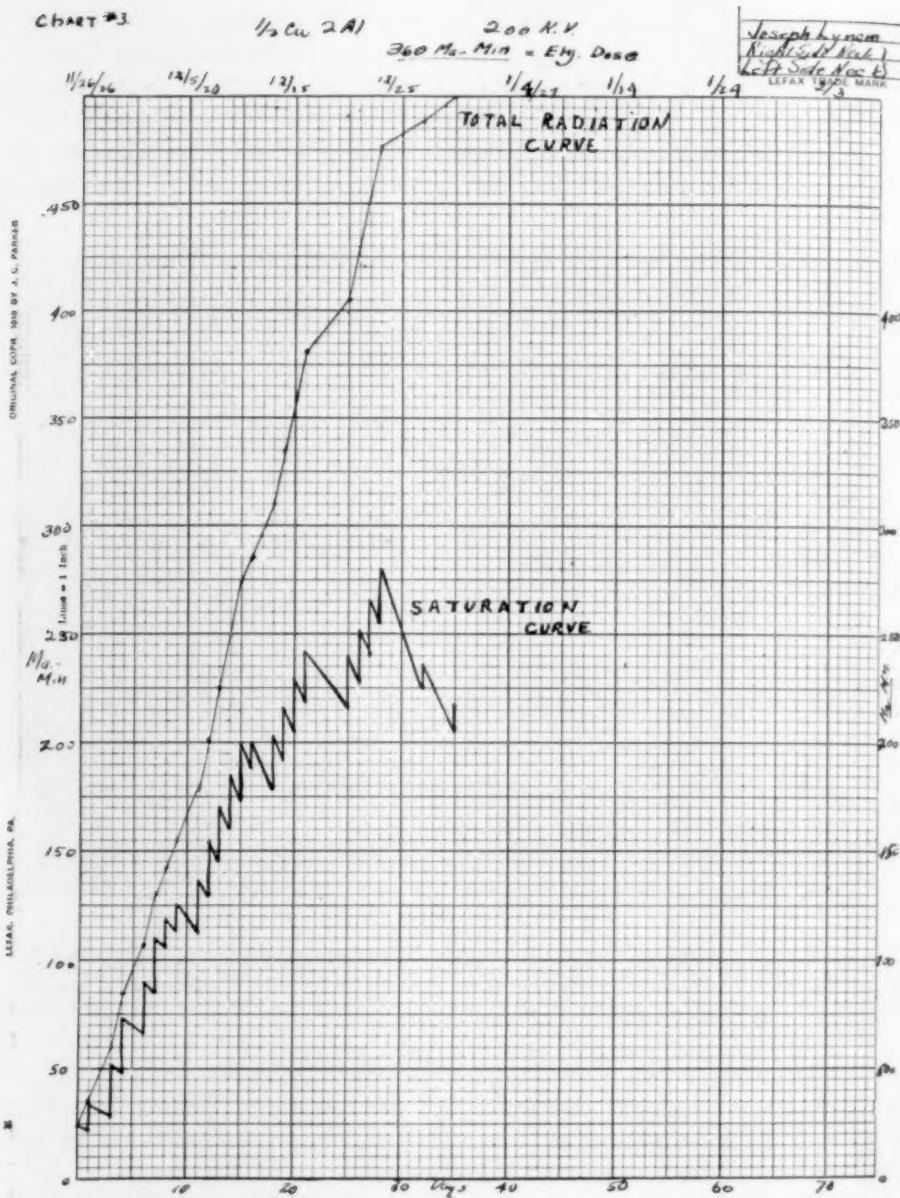


CHART 3 is a continuation of the treatment of Case I. These curves, however, are for X-ray. As the case was not progressing favorably under radium treatment, a course of X-ray was next tried. The machine factors and the filters are given at the top, the region will be noted in the right-hand corner at both sides of the neck. In the curve itself the abscissa represents the days and the ordinate milliamperere minutes. The light line represents the total radiation and the heavy line the saturation curve. It is to be noted that while a total of 500 milliamperere minutes was given in thirty-five days' time, the saturation curve never approached the erythema dose of 360 milliamperere minutes. This is due to the fact of the previous radium irradiation. This curve is continued in Chart 4.

CANCER OF TONGUE AND FLOOR OF MOUTH

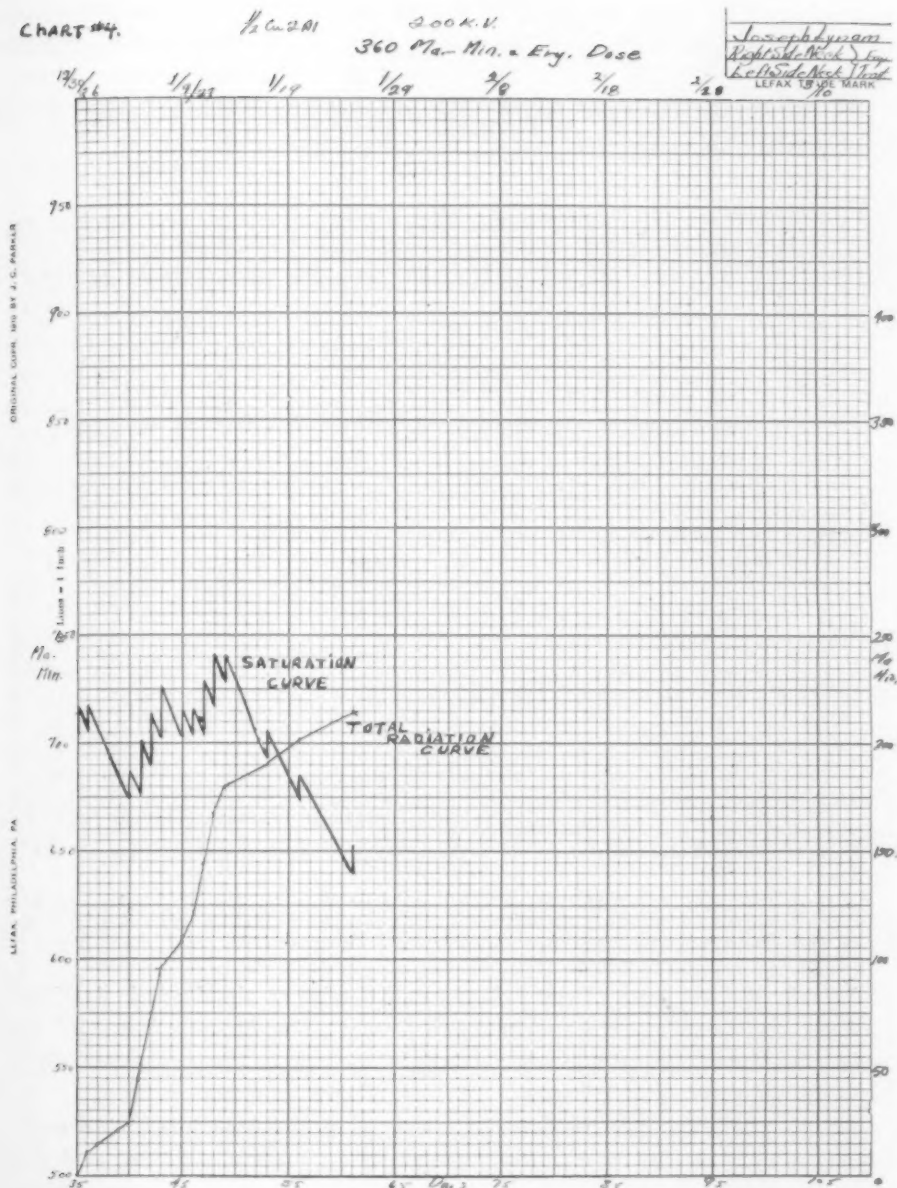


CHART 4.—Continuation of the treatment of Case I. Note that 715 milliampere minutes' irradiation were given and that saturation curve ranged between 200 and 250 milliampere minutes. Despite this irradiation the case had a fatal termination. A bilateral ligation of the external carotid arteries was done on September 2, 1926.

with a diagnosis of cancer that turned out to be syphilis, tuberculosis or actinomycosis.

Of the seventy-one patients with pathological examinations, the diagnosis was positive in sixty-two cases, although multiple biopsies were required in several of these. Of the remaining nine cases, chronic inflammation was reported.

Of the positive biopsies, twenty-five were squamous-cell and thirty-seven were prickle-cell carcinoma.

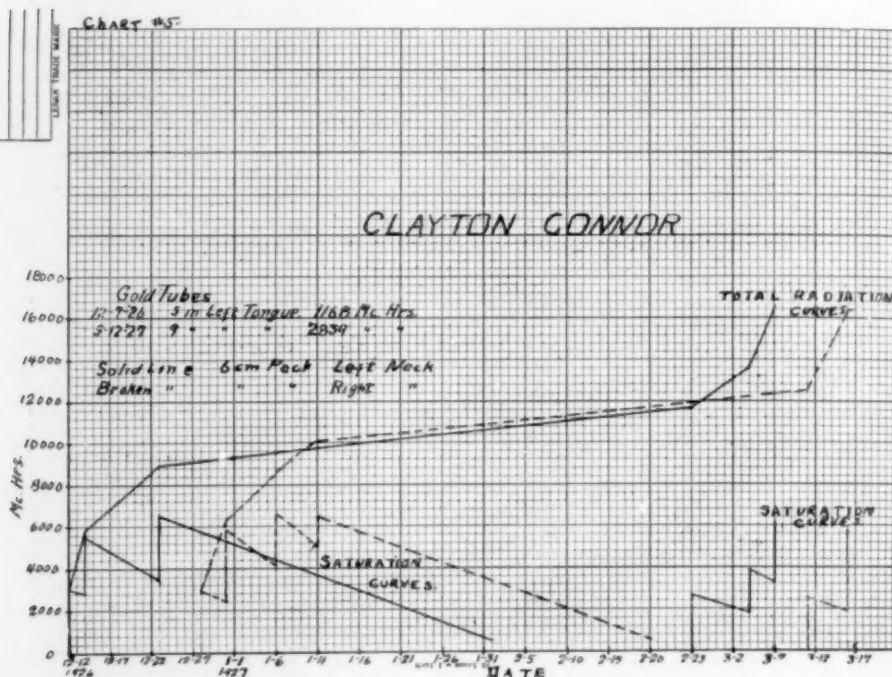


CHART 5.—Treatment of Case II. This patient lived six months and had a prickle-cell carcinoma of the tongue and glands at the angle of the left jaw. Local treatment of the lesion by means of gold tubes is given at the upper left-hand corner. The curves are self-explanatory.

Within the last year, Doctor Belk, pathologist to the Radiologic Clinic, has been grading these cases according to Broder's classification but this is too recent for us to draw any conclusions as to their clinical course from this classification.

Of the 164 cases, twenty or 12 per cent. were admitted in a dying condition and lived from one day to three weeks. Another group of eighty-five or 51 per cent. presented marked cachexia, extensive primary involvement and widespread neck metastasis when they first came under our care. They received moderate mild radiation as palliative treatment and died in from one to six months. There were twenty-seven or 16.4 per cent. patients who lived from six months to one year.

Analyzing this group, we find that twenty-four presented neck metas-

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tasis on their admission. Of the remaining three cases, one left our care and had an excision of the tongue at another hospital and returned four months later with hopeless neck metastasis not having received any radiation in the interval. He died in less than one month not having been treated by us. The other two patients did not show any neck metastasis on their admission but nevertheless died in one year.

The treatment in this group ranged from mild local and regional irradiation to very thorough and complete irradiation, as we will show subsequently with lantern slides.

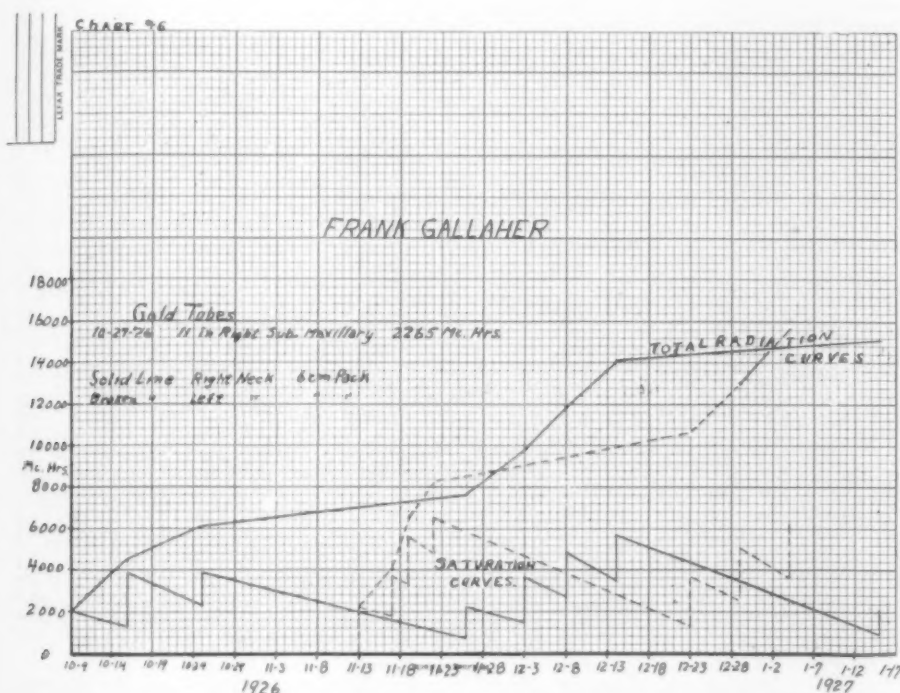


CHART 6.—Represents the irradiation of Case III. Age sixty-five. Lived eight months. When he first came under our care his primary lesion, floor of mouth, had been treated at another hospital. He showed a large submental mass and an entire disappearance of the primary lesion. The curves show the total amount of irradiation to both sides of the neck and the amount given by the saturation method. Besides this it will be noted that gold tubes were implanted in the right submaxillary region, a total of 2,265 millicurie hours.

In the group that lived from one to one and one-half years, there were seven or 4 per cent.

All of these cases with the exception of one, died. This living patient has shown marked regression of his disease, and it is at least temporarily controlled.

Three patients have lived between one and one-half and two years and they are all still alive. Two of these showed fairly far advanced primary lesions and enlarged submaxillary or anterior cervical glands. The third was an early case of the floor of the mouth with some thickening of the underlying submaxillary gland. Two of these patients are entirely free from all

evidence of disease (Potts and Stengel), the third had malignancy present when last seen but it seemed to be quiescent. He lives up the state and we have been unable to have him return for further treatment.

Two patients lived over two years but finally died of their cancer despite very active radiation. One showed neck involvement on admission, the other did not. They were both undoubtedly benefited by radiation. Two cases lived over three years. Both showed moderately advanced submaxillary and submental glands. They were thoroughly radiated and their lives were pro-

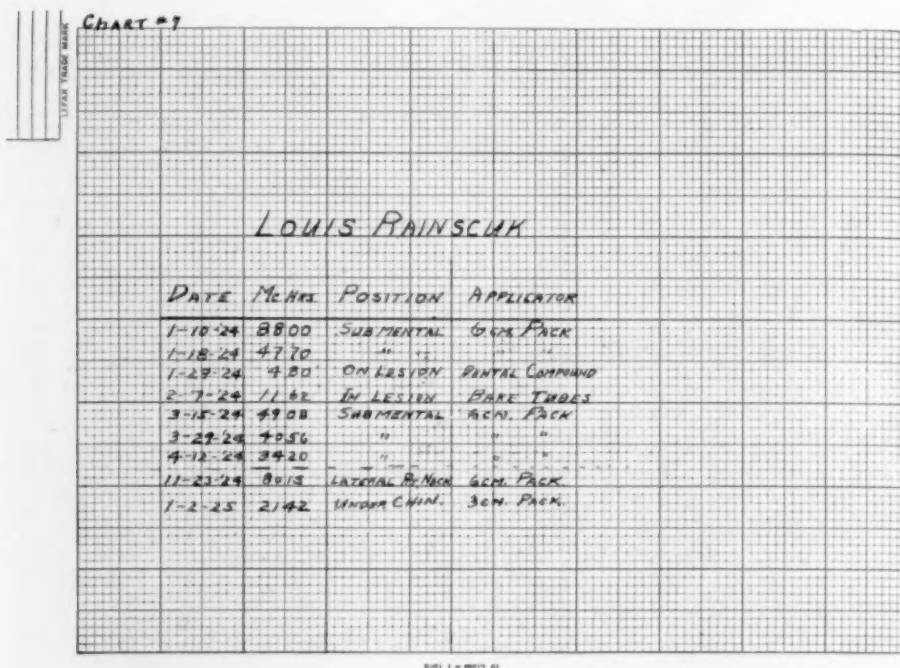


CHART 7.—Represents the irradiation of Case IV. Age fifty-four. Lived one year and one month while under our care. He had an extensive lesion of the floor of the mouth and a few enlarged submental glands. His irradiation being spread over one year's duration, could not easily be plotted in a curve so it is presented in tabulated form.

longed by the use of radium. Life was prolonged for five years and seven months in one patient by irradiation before he finally succumbed to his cancer. The remaining cases will be discussed later when we consider our arrested cases.

Autopsies were performed in fifteen of the patients. None of these cases showed metastasis beyond the neck. This is particularly interesting to us as we have at present a patient who shows complete disappearance of his primary lesion at the tip of the tongue; one hard stony gland in the left side of his neck apparently inactive and yet his liver is very markedly enlarged and has the characteristics of metastatic cancer. Nine of the autopsied patients showed severe pneumonia—purulent in some cases and multiple lung abscesses in others.

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One patient died of retropharyngeal abscess, 150 c.c. of pus being evacuated at autopsy.

Apropos of the cause of death, we find that twenty patients had one or more hæmorrhages from the mouth or neck and nine patients bled frequently and severely enough to die of the effects of hæmorrhage.

We had five operative deaths in the series. We found that we must do all possible operative procedures under local anæsthesia, our patients being usually poor operative risks.

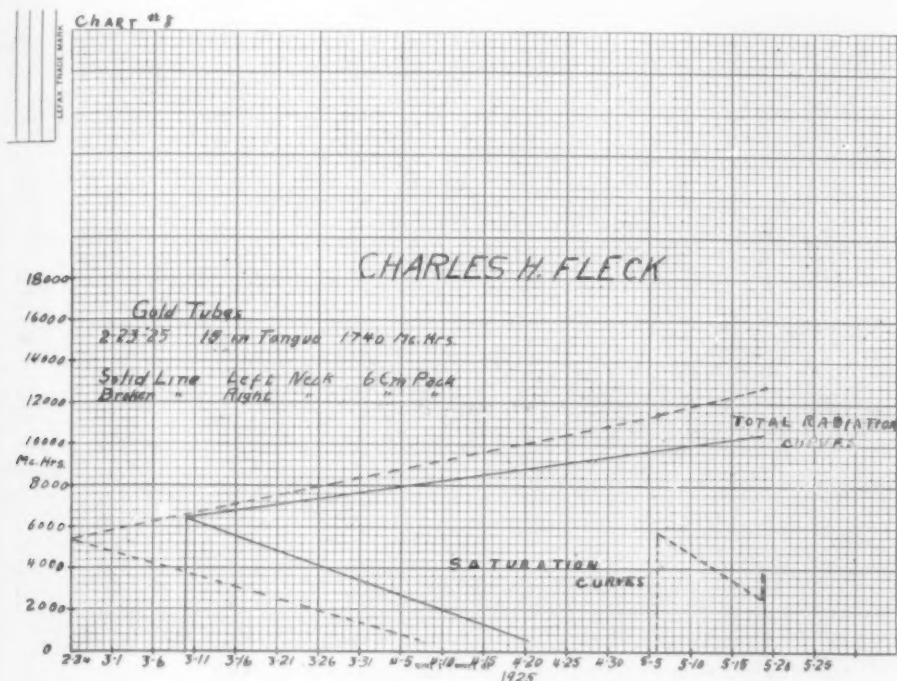


CHART 8.—Represents the irradiation to Case V. Age forty-four. Lived seven months. This patient was first treated for syphilis by his family physician who finally referred him to another hospital where a biopsy was taken and radium treatment given. He was finally referred to us with two ulcers of the tongue. We advised excision of the tongue which was refused. Biopsy showed squamous-cell carcinoma. The curves show that this patient was not treated as vigorously as the preceding cases. In fact he received only two treatments to each side of the neck of approximately 6,000 millicurie hours each. He rapidly became hopeless and died in seven months.

One patient died the day following incision of the neck and implantation of bare tubes; a second following excision of the tongue; a third after a Janeway gastrostomy; a fourth one day after bilateral ligation of the external carotids, electrocoagulation of the cheek and tongue, and radium implantation around the coagulated lesion. The fifth patient died three days after a bilateral ligation of the external carotids.

In regard to the total operative procedures done of these patients, seven were electrocoagulated; four had a Janeway gastrostomy; fourteen had alcoholic injection or resection of the fifth nerve and the superficial cervicals; ten had unilateral or bilateral ligation of the external carotids.

The low incidence of the electrocoagulation is due to the advanced stage at which we first saw these patients. Nothing short of a total excision of the tongue and a complete block dissection of the neck would remove the malignancy, and the general condition of these patients made such an operation impracticable.

We feel that electrocoagulation has a definite place in the treatment of cancer of the tongue and floor of the mouth, as we will outline later.

Recourse was had to gastrostomies when swallowing became difficult or

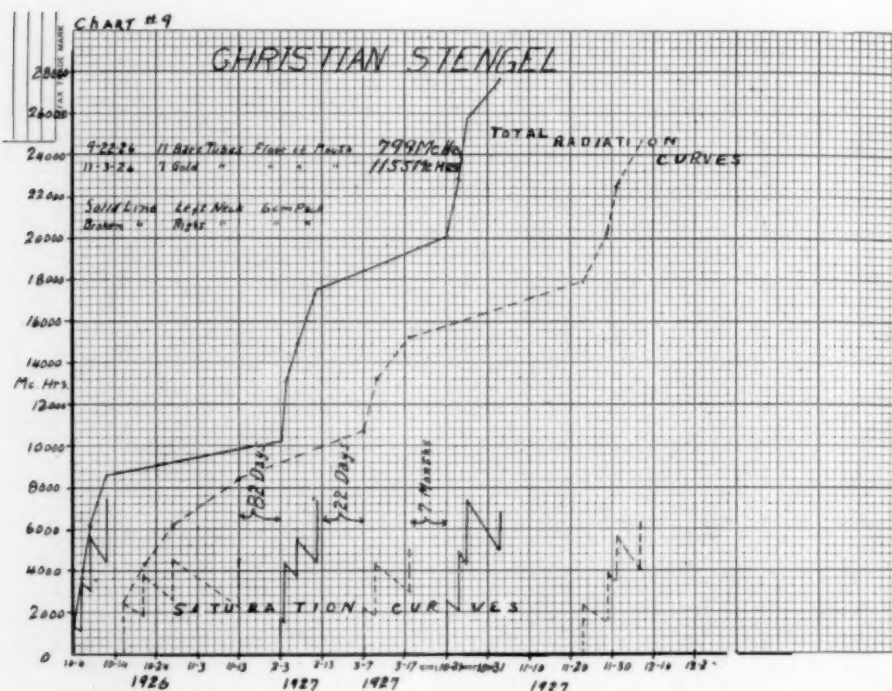


CHART 9.—Represents the irradiation of Case VI. Age sixty-seven. He first came under our care on September 16, 1926, with a prickle-cell cancer of the left floor of the mouth and no demonstrable adenopathy. He is alive to-day and free from all evidence of cancer. A study of the curves will show that he got four series of neck irradiation. The treatment of the local lesion by means of glass tubes and later gold tubes is given in the upper left-hand corner.

impossible. However, this was used only as a last resort as nasal or oral feeding through a Rehfuß tube was practiced as long as possible. This greatly decreased the number of gastrostomies and the importance of doing this will be recognized when we note that two of the four patients died; one the day of the operation and the other four days later.

Probably the greatest help we were able to give these patients in their advanced stage of cancer was the relief of their pain.

In the lesions of the tongue, floor of the mouth and neck, we have mainly to deal with the nerve supply through the third division of the fifth nerve and the branches of the cervical plexus. As these patients do not have a very long span of life, we have been content in most instances with the extracranial

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operations. However, in two of the cases a craniotomy and cutting the sensory root of the fifth nerve was performed; six had alcoholic injection of the Gasserian ganglion; five had alcoholic injection of the third division at the foramen ovale; one had alcoholic injection of the lingual nerve, and seven had resection of the branches of the cervical plexus.

All of these patients were greatly relieved; did not require any more morphine; slept well when previously they had not.

The relief of pain in cancer of the mouth is particularly important because

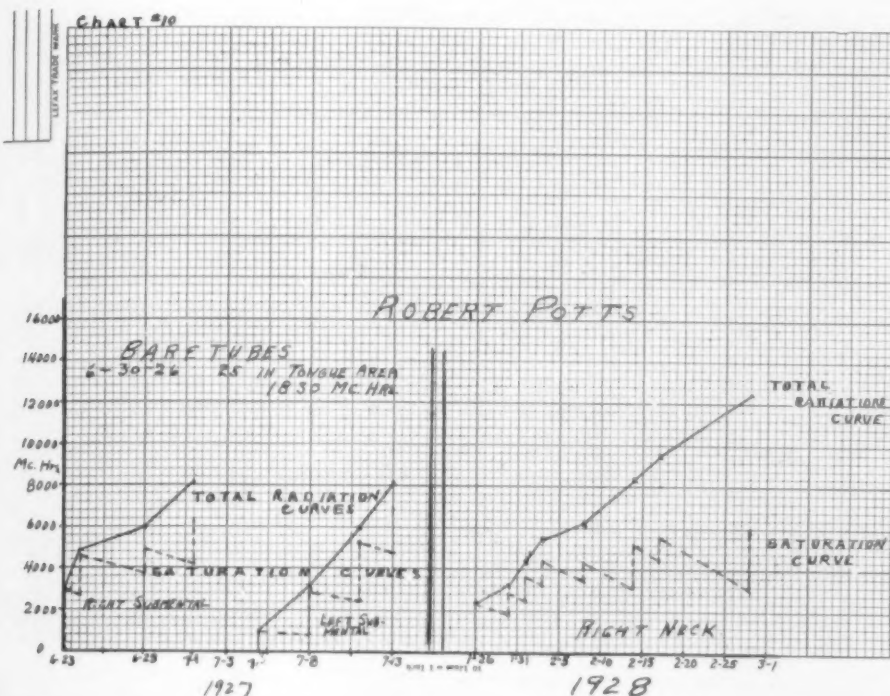


CHART 10.—Represents the irradiation of Case VII. Age seventy-four. First came under our care June 21, 1926, with a prickle-cell cancer of the under surface of the tongue and floor of the mouth and three or four palpable glands in the right side of the neck under the sternomastoid. He is free from all evidence of cancer at present. The curves are self-explanatory and the local treatment of the lesion is given at the upper left-hand corner.

it enables these patients to sleep and eat when previously they had been unable to do either. Loss of sleep and inability to eat rapidly puts these patients in a very wretched condition and contribute to a rapid and fatal termination.

The measures we have enumerated above do not completely relieve all pain, as some of these patients, particularly those who have had lesions of the posterior one-third of the tongue still complain of pain on swallowing and it is usually referred to the ear. This is probably through the glossopharyngeal and vagus nerves and is very troublesome and very hard to treat.

In some instances where an indurated ulcer is present in the tongue, thorough coagulation will relieve the pain. Deep cervical pain is also present being carried through the deep branches of the cervical plexus which are

mixed motor and sensory nerves. It has been our custom to resect only the superficial cervicals which are purely sensory.

We recommend unilateral or bilateral ligation of the external carotids in all cases in which severe face or intraoral operations are to be done, as this makes the procedure practically bloodless and so reduces the shock of the operation; the incidence of lung complications and the liability of secondary hæmorrhages. We also employ this measure to control the slow, steady ooze which some of these patients show and which lead to very severe secondary

CHART #11

HENRY ELKINGTON

Date	Index	Position	Applicator
6-25-23	240	Floor of Mouth	Dental Compound
7-6-23	8412	Rt. Neck	6 cm. Pack
7-12-23	4304	Lt. "	" "
7-16-23	3147	" "	" "
7-27-23	1109	Ext. Lesion	Garg. Tubes - 12
9-17-23	389	" "	" "
10-25-24	3033	Rt. Neck	6 cm. Pack
1-8-25	2340	" "	3 cm. "
1-16-25	2762	Lt. "	6 cm. "
5-23-25	3402	Rt. "	" "
6-7-25	2404	" "	" "
10-9-25	6332	" "	" "
1-13-26	4524	" "	" "
1-25-26	3112	" "	" "
3-10-26	2544	" "	" "
3-24-26	2258	" "	" "
5-31-26	2350	Lt. "	" "
8-7-26	964	" "	" "
6-16-26	2860	Rt. "	" "

CHART 11.—Represents the treatment of Case VIII. Age seventy-three. He first came under our care June 25, 1923, with a squamous-cell cancer of the floor of the mouth, frenum of the tongue and mucosa of the lower jaw quite extensive. He is now entirely free from all evidence of cancer. His treatment extended over three years and so a curve could not be very easily plotted. The treatment is tabulated above.

anemia, if it is unchecked. Finally we ligate the external carotids to control hæmorrhage in the mouth.

We have done this operation on ten patients in this series and it is very easily and quickly performed under local anæsthesia. One patient died the day of operation but as he also had an excision of the tongue, this death belongs to the latter operative procedure. Another patient died three days following a bilateral ligation of the external carotids, extraction of the teeth and implantation of gold tubes. He received ether anæsthesia, never rallied from the operation, and died in coma. He showed no embolic symptoms. Two patients showed cerebral symptoms. One developed a left hemiplegia after a bilateral ligation of the external carotids which was permanent. He

CANCER OF TONGUE AND FLOOR OF MOUTH

lived for three months following this. The other patient developed a right arm paralysis, twitching of the right side of the face, and partial facial palsy. This all cleared up except for the paralysis of the right forearm. He died eleven days after operation. In the other patients, no symptoms were noted; not even a change in the pulse rate. We have performed this operation a number of times without any mortality or morbidity but in these patients, the lesions were not situated in the tongue or floor of the mouth so they cannot be included in this series. Curiously enough, our entire mortality and morbidity falls among the tongue and floor of the mouth cases which gives us a higher percentage in this particular series, whereas, as a matter of fact, the mortality and morbidity percentage is very low when we consider our entire number of unilateral or bilateral external carotid ligations.

Before leaving this subject, we would like to call your attention to one patient who died of the effects of hæmorrhage of the mouth although the external carotids had been ligated two and one-half months previously. This proves conclusively that the circulation reestablishes itself and the anemia is of short duration. Dawbarn says in from seven to ten days.

Other operative procedures consisted in tracheotomies in three cases; sequestrectomy from the inferior maxillæ in two cases; a very low rate considering the intensive radiation that some of these patients received; incision of the neck and implantation of bare tubes in eight cases and a total block dissection of the right neck and subtotal dissection of the left neck and amputation of the anterior part of the tongue in one case.

We are disregarding the great number of cases in which gold tubes or bare tubes in the earlier years were implanted in the lesion although an anæsthetic was often administered.

Method of Treatment.—In our service at the Philadelphia General Hospital, we have had excellent opportunities to see the results of other clinics and we have come to the conclusion that no one method is the ideal way to treat cancer of the tongue and floor of the mouth. The good results have of course not come to us but the bad results have had every form of treatment possible before coming to us. Some have had surgery alone, local excision and removal of the glands of the neck. Others have had electrothermic coagulation of their lesions and some have had X-ray or radium treatment of their necks while others have not. Still another class has been treated with radium alone, although this has usually been inadequate from the standpoint of sufficient dosage.

We feel that the treatment of cancer of the tongue and floor of the mouth must be modified to the type of patient, and we advocate in those cases that are good risks and whose disease has not spread so that they are in the hopeless class radium packs to the neck, gold tube implantation into the lesion in sufficient dosage to either entirely destroy the lesion or to cause a sharp radium reaction. At the end of ten to fourteen days electrocoagulation of the lesion with possibly a preceding bilateral ligation of the external carotid,

depending upon the extent of the lesion. The neck radiation at a distance of 6 cm. is continued on both sides until an arythema dose of 10-15000 millicure hours has been given. We like to give this in five divided doses at two day intervals. Six weeks rest is then indicated and the patient is observed and further treatment carried out if indicated.

We have discontinued all block dissections of the neck and radical excisions, as we feel that more can be accomplished with the radiation and we are faced with a 10 to 20 per cent. mortality in this particular type of case we see in the Philadelphia General Hospital when we attempt any radical surgery.

In patients who are a poor surgical risk and yet have an early or only moderately advanced cancer, we carry out the treatment advocated above except that we do not always coagulate the lesions. Sometimes in these patients after the gold tubes have been inserted, the lesions have so far regressed or have entirely disappeared so that coagulation is not indicated. Such has been the case in the three patients we are showing to-night.

In advanced cases, we either do not treat them at all, or else we radiate their metastatic nodes vigorously and implant gold tubes into them and into the primary lesion. We regret to say that we have been unable to cure any patients with metastatic nodes to his neck by irradiation. We have caused them to shrink down and have held them in check for a time, but sooner or later, these patients died of their cancer.

We have only been using gold tubes since the fall of 1926 and our results have been better since their use.

Arrested Cases.—In this series there are nine patients in whom their cancer has been arrested, and who show no evidence of their disease at present. Four patients are alive over four years. One patient died after four years. He had a very thorough autopsy. He died of a retropharyngeal abscess. No cancer could be found. Two patients are alive over four years and the remaining patients—one, two years and four months and the other one year and eight months. Some of these patients have been asked to come here to-night for demonstration.

We now propose to show a few lantern slides of curves of the radium treatment administered to some of these patients. We are indebted to Mr. Weatherwax of the Philadelphia General Hospital for these drawings. These slides are divided into two groups, the first group had a fatal termination despite the fact that they were thoroughly irradiated and the second group is now free from all evidence of cancer. These curves represent fairly well the degree and type of radiation that is given at the Philadelphia General Hospital.

CONCLUSIONS

No reports of cures unless confirmed by pathological examination should receive serious consideration.

Gold tubes have supplanted any other single method of treatment

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of cancer of the floor of the mouth and should be combined with regional irradiation.

Electrocoagulation of the lesion is desirable where conditions permit.

Ligation or excision of the external carotids is essential before any radical intraoral surgery.

The relief of pain is an important problem in treating cancer of the tongue and floor of the mouth.

These results do not compare with those of our private patients where we receive cases in better general condition and where the disease has not made such progress.

DEEP PULSION DIVERTICULA OF ŒSOPHAGUS

BY MORRIS K. SMITH, M.D.

OF NEW YORK, N. Y.

A TWENTY-SIX-YEAR-OLD matron entered St. Luke's Hospital on account of difficulty in swallowing. The symptoms began about one year before, with a sense of discomfort on eating, beneath the lower end of the sternum, to relieve which she induced vomiting. During the intervening period there had been few days in which food had not been brought up either voluntarily to relieve distress or involuntarily. She could not get solid food down. On some days liquids would go well, on others even water was returned. She had lost eighty pounds.

She was a thin young woman not acutely ill. Neither at the first examination nor later did she seem at all neurotic. Except for the poor condition of her teeth, there was nothing of note on physical examination. Fluoroscopic and radiographic examination by Doctor Mackie revealed cardiospasm, with a diverticulum of the lower œsophagus extending forward and to the left. The size of the diverticulum is estimated at 2.5 by 2 cm. The œsophagus was much dilated. Following the passage of œsophageal bougies over a previously swallowed thread, the cardia was dilated by Dr. Nathan W. Green. The patient was greatly improved by the treatment, could eat again and promptly gained thirty pounds. She, however, failed to report regularly for the passing of the bougies and continues to have retro-sternal discomfort at times.

The finding of the diverticulum in this patient raised the question as to its significance—whether it was a casual factor in the cardiospasm, whether in itself responsible for symptoms, and in general the problem of the importance of such diverticula. To answer these questions a review of the literature was made.

Diverticula of the œsophagus are divided generally for purposes of description into two varieties, the traction and pulsion types. The traction diverticula are due to the retraction of inflammatory tissues, usually lymph-nodes, which have become adherent to the wall of the gullet. They are found on the anterior wall, are tent shaped and rarely attain a depth of as much as a centimetre. The greater number occur at about the level of the bifurcation of the trachea where lymph-glands are numerous. They do not cause symptoms and their chief clinical significance is the possibility of perforation with ensuing fatal mediastinitis, which has been known to occur.

Pulsion diverticula, so called because they are thought to be due to pressure from within, can occur at any level of the œsophagus. Of these the pharyngo-œsophageal variety form the greater number. They arise

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from the posterior wall at the junction of the pharynx and œsophagus, cause increasing dysphagia and are amenable to surgical treatment. The condition is a well understood clinical entity and does not fall within the scope of this paper.

Pulsion diverticula below the pharyngo-œsophageal level are unusual findings whose significance has not been clarified. The majority reported have been of the lower third of the gullet, and in this situation they are often designated as epiphrenal.

A combination of the two varieties, known as traction-pulsion diverticulum, is also described. It is supposed to begin as a traction and then take on the characteristics of a pulsion diverticulum. It is probable that a few of the cases referred to in this article fall in this class.

In a review of the literature one comes across a small group of cases, reported before X-ray examination was in use or perfected, in which diagnoses of epiphrenal pulsion diverticula of large size, 100 to 500 c.c. content, were made (Kelling,¹⁶ Mintz,¹⁸ Jung¹⁵). These patients suffered from dysphagia and vomiting. The diagnosis rested on tube tests more or less complicated. At least one such case has been eventually proved to be cardiospasm with dilatation of the œsophagus (Spivak²²).

Because similar cases have not been reported of late years since modern X-ray technic has been available and because no such large sacs have been demonstrated at autopsy as far as I have found, it has seemed best not to include them.

Post-mortem reports are few and for the most part incidental findings. Reichman²⁰ stated that Przewoski searched the gullet carefully at autopsies over a period of five years and found seven pulsion diverticula of the middle and lower third, the size of a hazlenut. Brosch¹¹ reported, from autopsy material, four deep œsophageal diverticula, two at the level of the bifurcation of the trachea and two epiphrenal. All were walnut-sized. He described them as herniations through the muscular tissue of the gullet, containing only a few muscular fibres in the wall. They were incidental findings. Kraus¹⁷ reported an autopsy specimen of a dilated œsophagus on the left forward side of which was a diverticulum the size of an apple with an opening 6 by 3.5 cm. It had fibrous, thickened walls lined with mucous membrane and separated the muscle of the gullet in its development. Carman¹² refers to other reported specimens; one (Oekonumides) 5½ cm. deep and 8½ cm. above the cardia and one (Olivetti) the size of a hen's egg just above the diaphragm.

I have been able to find autopsy reports on three cases which were recognized during life. Two of these (Stierling,⁷ Kaufman and Kierbock⁶) were in patients with cardiospasm. In both instances the sac was 5 cm. in diameter, one a hand's breadth, the other an inch, over the diaphragm. The symptoms were those of cardiospasm. The diverticulum in the third case (Bensaud, Gregoire et Guenaux¹⁰) was the size of a turkey's egg, epiphrenal, coming from the left anterior part of the œsophageal wall. It was made up

of epithelium and fibrous tissue. The patient, a man of fifty-six, had complained of vague abdominal symptoms. A month before death he vomited up some cherries without effort on two or three occasions. He died of pneumonia.

Whether so-called deep pulsion diverticula of the œsophagus are originally congenital, or arise in some weak spot in the wall, it seems probable

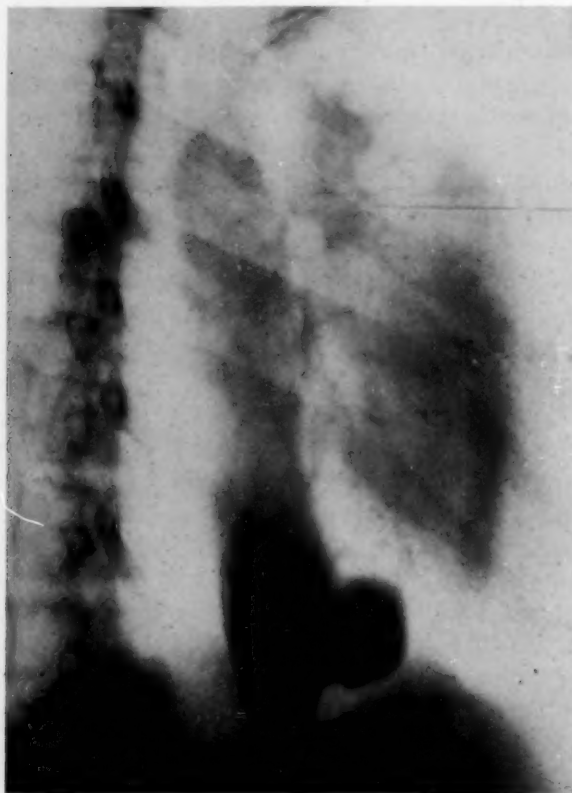


FIG. 1.—Cardiospasm and diverticulum of the lower end of the œsophagus before treatment.

that pressure from within is a factor in their development. It is natural to reason that in cardiospasm the conditions are especially favorable for their production.

As far as I have found there are eleven clinical cases, besides my own, reported in which diverticulum other than pharyngo-œsophageal has been associated with cardiospasm. At the same time without trying to collect all other cases, I have come across more than twice as many in which cardiospasm was not reported, although the description in a few of these suggests it.

In the case reports there have been a preponderance of males over females of more than two

to one. The ages have varied from twenty-two to seventy-eight; middle and advanced life supplying the greater number. In the group associated with cardiospasm the average age is lower.

The size of these diverticula as found at autopsy has already been discussed. The X-ray has shown smaller examples. The comment of von Hacker and Lotheissen²³ in *Neue Deutsche Chirurgie* that deep-seated diverticula are for the most part not very large, the size of a pea, a hazelnut, or at most a small apple, states the case. The location of the diverticulum is in the lower third of the gullet in the great majority of cases. A moderate number are found in the mid-portion and a very few in the upper portion. Multiple diverticula are noted in a few instances. Decidedly more are found

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on the right than on the left side; and more are noted as coming from the anterior part of the œsophagus than the posterior.

The question as to whether deep diverticula of the œsophagus cause symptoms is the crux of this inquiry. It seems reasonable to think that the larger ones at any rate may do so; although the evidence for it is limited.

Pharyngo-œsophageal diverticula cause a well-defined symptom complex of increasing severity which may lead to the death of the individual from inanition. There is a difference, however, between deep diverticula and the pharyngo-œsophageal in that the former are more or less rounded saculations of the gullet with good-sized openings, whereas the latter become dependent pouches.

Among the cases collected of deep diverticulum associated with cardiospasm the symptoms were those of cardiospasm, and were relieved by treatment of the cardiospasm in spite of the persistence of the diverticula.

When it comes to the cases without cardiospasm, while the majority had no symptoms referable to the œsophagus and were accidental findings, a few presented complaints that seemed related to the diverticulum.

CHASSARD¹² reported the case of a woman of seventy-two who had suffered from gastroptosis and hyperchlorhydria for many years. For several months eating had been accompanied by distress located behind the lower end of the sternum, and persisted for two or three hours after the meal. In consequence of this she had curtailed her food and lost weight. There was no regurgitation. X-ray showed an epiphrenal diverticulum to the left and slightly posterior, of a size between a pigeon's and a chicken's egg. It emptied in about three hours. There was no spasm seen. This patient was given an oily substance before meals. Following this treatment the symptoms diminished and she gained weight.

DESSECKER'S¹⁴ patient, a man of twenty-two, complained of pain under the breast

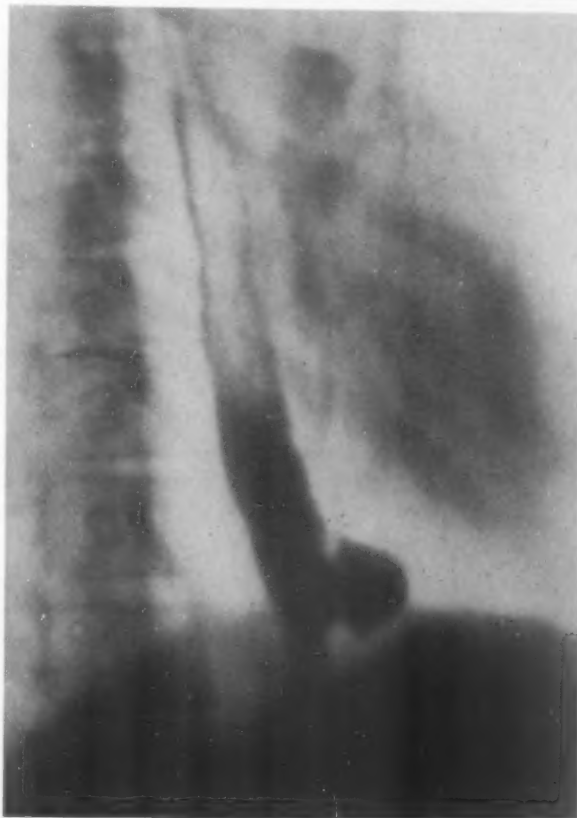


FIG. 2.—Cardiospasm and diverticulum of the lower end of œsophagus after dilation.

bone and in the shoulder after eating. There was a good sized epiphrenal diverticulum behind and to the right. He never observed any evidence of cardiospasm.

The patient of BENSARD, GREGOIRE and GUENAU¹⁰ with an epiphrenal diverticulum who came to autopsy has been described. Effortless vomiting of cherries on two or three occasions seems the only item in the history which could be connected with the œsophageal pathology. A second patient of the same authors, a man of sixty-nine, had a sensation of food stopping in the gullet. He had a diverticulum 2 cm. long and four fingers' breadth above the diaphragm. The œsophagus was not dilated.

L. A. SMITH²¹ reported a patient who complained of food lodging in the lower gullet. He had angina pectoris. X-ray showed a diverticulum of medium size coming off from the right anterior wall of the middle of the œsophagus. It seemed to be adherent to the aorta.

MONTZKA¹⁹ described a man of fifty who had a peculiar foreign-body sensation in the precordial region on swallowing, and felt as if little particles stuck in the gullet. On the right anterior wall of the gullet there was a hazelnut-sized diverticulum connected by a narrow pedicle with its lumen. There was a little delay in the passage of food by the diverticulum.

These cases are not impressive as demonstrations of symptomatology due to diverticula. They suggest, however, that the condition cannot be regarded as always innocent. Among the cases collected in which cardiospasm is not mentioned, there are several with symptoms which seem to me to be probably due to cardiospasm.

The question arises when diverticulum and cardiospasm are associated as to whether the former as a source of irritation may not cause the latter.

Kaufman and Kierbock⁶ report a case in which they think that this was the sequence of events, as the patient had only had symptoms of cardiospasm for two weeks before the presence of the diverticulum was proved. On the other hand, cases of cardiospasm are relieved of their symptoms by appropriate treatment, although the diverticula remain. The question cannot be definitely answered but it seems improbable that the diverticula bear any important etiological relation to cardiospasm.

In the light of the evidence, therefore, we must conclude that deep diverticula are not of great importance and if found can be ordinarily disregarded. In the presence of cardiospasm, its treatment is sufficient. If there are symptoms in cases without cardiospasm they may be treated also by dilation. Operative removal has been attempted with fatal result.

Summary.—A case of cardiospasm in which there was associated deep pulsion diverticulum of the œsophagus is reported.

A search of the literature reveals eleven similar cases, making twelve in all, and many more of deep diverticulum of the œsophagus without cardiospasm.

These diverticula vary in size from a pea to a small apple. They are most numerous in the lower end of the gullet.

Ordinarily they are accidental findings and do not cause symptoms, although a few cases are cited in which mild symptoms are reported.

It seems unlikely that deep diverticulum is of importance in the etiology of cardiospasm.

DEEP PULSION DIVERTICULA OF ŒSOPHAGUS

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PRIMARY EXTRARENAL HYPERNEPHROMA *

By ALBERT E. BOTHE, M.D.

OF PHILADELPHIA, PA.

FROM THE AGNEW AND HUNTER LABORATORY OF SURGICAL PATHOLOGY OF THE UNIVERSITY OF PENNSYLVANIA

ALTHOUGH hypernephroma usually originates in the kidneys, it may develop in other organs. Two years ago I presented before this Society an experimental and clinical study on hypernephroma. At that time it was concluded from the embryological and pathological observations that the hypernephromata were polystructural tumors of adrenal rest origin.

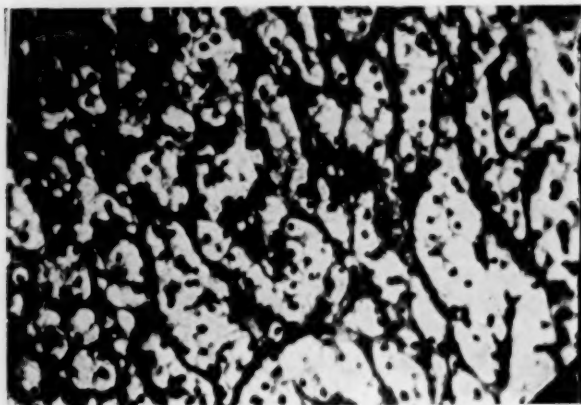


FIG. 1.—Adrenal-like Cellular Arrangement.

The present studies, the results of which are described herewith, were made upon a primary extrarenal hypernephroma with the idea of comparing the histological findings of this tumor with those of the renal hypernephroma.

The paper comprises, first, an outline of the patient's history; second, a tabulation of the tissues in which adrenal rests have been found; third, a tabulation of the tissues in which primary hypernephromata have been found, and finally a discussion of the pathological findings.

CASE HISTORY.—The patient, a white male, aged seventy-seven years, was admitted to the University Hospital on the service of Doctor Eliason, with a chief complaint of nausea and epigastric pain. The patient was in good health until eighteen months before his admission, at which time he had a sharp epigastric pain, nausea and vomiting. Since then he has had intermittent attacks of postprandial abdominal distention and discomfort. These sensations occurred immediately after eating and they were relieved by eructations of gas. These symptoms became increasingly more prominent and weakness was progressive. He had been eating lightly, not on account of anorexia, but because the food seemed to "stick on the way down". Water caused the same symptoms as food. There were no severe attacks of pain since the original one. There was a marked tendency to constipation with remissions but never diarrhoea. He believed his abdomen had recently grown larger. Hemorrhoids were present periodically for years, but during the last few months they were a constant source of discomfort. His cardio-respiratory and genito-urinary history as well as his past medical, social, and family history, were negative.

Physical Examination.—The patient was a thin, poorly nourished, somewhat dehydrated appearing white male, seventy-seven years of age. He did not appear acutely ill. The physical examination was essentially negative except for the abdominal findings.

The abdomen was slightly distended. Neither superficial tenderness nor rigidity were

* Read before the Philadelphia Academy of Surgery, May 14, 1928.

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present. On palpation a mass about the size of a grapefruit was felt in the upper right quadrant. The mass was smooth, tense and slightly movable. It was somewhat tender and moved with respiration. The intestinal peristalsis was of the intermittent booming type. Free fluid was demonstrable in the peritoneal cavity. The gastro-intestinal X-ray showed multiple points of stasis in the small intestine indicating slight obstruction.

The preoperative diagnosis was carcinoma of the upper abdomen of uncertain origin and chronic intestinal obstruction. An exploratory laparotomy was advised and performed by Doctor Eliason.

The abdomen was opened through a paramedian incision. The tumor felt on physical examination was easily exposed. It was found to be arising from the soft tissues in the region of the right adrenal gland. There was no evidence of intestinal obstruction. The liver contained metastatic tumors. On account of the metastasis to the liver further surgery was felt to be contraindicated. On the fourth day following operation the patient developed signs of respiratory infection. He rapidly became weaker and died from bronchopneumonia on the fifth day.

A post-mortem examination of the abdominal cavity showed the tumor which was found at operation to be definitely attached to the soft tissues just above the right adrenal glands.

The tumor measured 12 by 8 by 7 centimetres. It was well encapsulated except at its point of soft tissue attachment. It was tense and on section bulged slightly. It had a yellowish fatty appearance. There were different sized irregularly outlined cystic cavities which contained necrotic and haemorrhagic material. The liver was slightly enlarged. This enlargement was due to three fairly well circumscribed tumors which measured about five centimetres in diameter. What

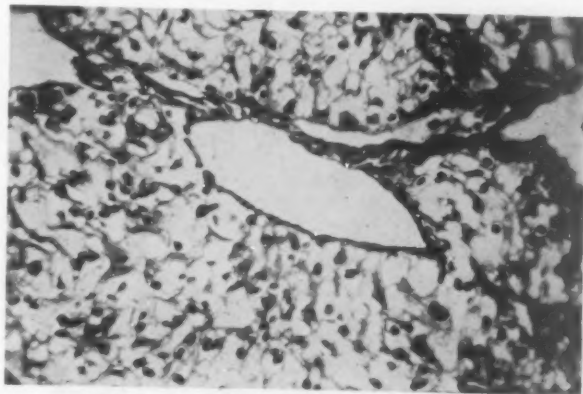


FIG. 2.—Endothelial Cellular Arrangement.



FIG. 3.—Papillary Arrangement.

true of the gross appearance of the large tumor was true of the smaller ones in the liver. Except for the lymph-nodes in the upper abdomen there was no gross evidence of tumor in any of the other organs or tissues, the kidneys and adrenals having been very

carefully examined. Many sections were cut from different areas in the tumors which will be described later.

ADRENAL RESTS

Although adrenal rests are frequently found at autopsy and show a fairly wide distribution they are in entire accord with the embryological possibilities.

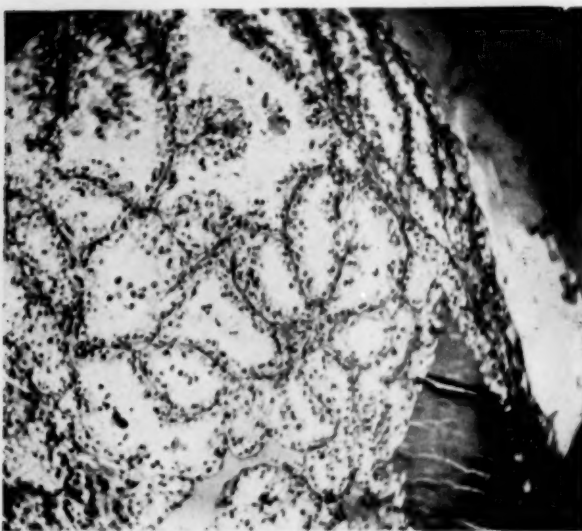


FIG. 4.—Alveolar Arrangement.

The anlage cells of the adrenal are so situated in their embryonic state with respect to the liver, kidney, ovary, testicle, epididymis and uterus, especially in embryos from 12 to 16 millimetres in length, that one can easily see the possibility of adrenal cell inclusions in these organs.

A tabulation of the tissues and organs in which adrenal rests have been found is shown in the following table.

TABLE I.

1. In the male.—In the rete testis and epididymis; in the paradidymis; on the spermatic cord, in the inguinal canal, and above and below the same.

2. In the female.—In the ovary, where they may easily be mistaken for shrunken corpora lutea; on the tubes.

3. In both sexes.—In the retro-peritoneal tissue below the poles of the kidneys; along the internal spermatic and ovarian veins; on the iliopsoas muscle at the brim of the pelvis; at the sacro-iliac synchondrosis; in the capsule of the kidney, and in the kidney substance; on the wall of the neighboring vessels; in the solar and renal sympathetic plexuses; between the transverse colon and the spleen; in the right lobe of the liver; in the pancreas.

(Tabulated by Broman.)

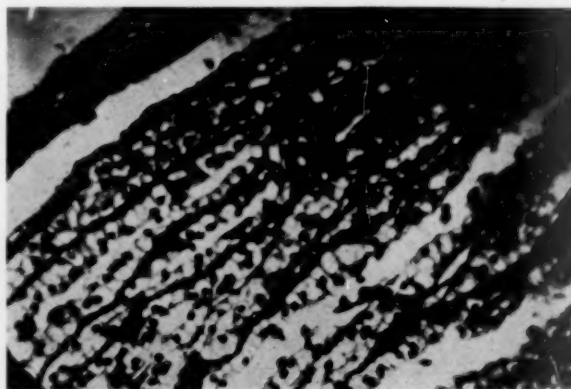


FIG. 5.—Tubular Arrangement.

PRIMARY HYPERNEPHROMATA

The occurrence of primary hypernephroma is most frequent in the kidney. A review of the literature gives evidence that hypernephromata may

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develop primarily in any of the tissues in which adrenal rests have been found. A tabulation of the tissues and organs in which primary extra renal hypernephromata have developed is shown below.

TABLE II.

Liver	Adami and McCrae, Rolleston, Schmorl, Vecchi and Noyes.
Falciform ligament.....	Starr.
Adrenal	French, Linser, Orth, Dobberty, Tilesius, Cooke, Beverant and Ravikild, Colcott, Fox.
Ovary	Givven, Peham, Scudder, Glynn.
Broad ligament.....	Weiss, L. Pick, Glynn.
Spermatic cord.....	Chevassu, Debernardi.

Microscopical Studies.—Many sections were made from practically every area of the large tumor. The predominating cells, while presenting slight variation in size and shape, were of the large polygonal type consisting of a large nucleus surrounded by a clear vacuolated cytoplasm. The nuclei in most cells stained deeply. Mitotic figures were frequently seen. Although the predominating cells showed some difference in size they all appeared to be of one type, with the greatest diversity of arrangements.

The cellular arrangements noted in this tumor were: 1. Adrenal. 2. Endothelial. 3. Papillary. 4. Alveolar. 5. Tubular.

The details of the cellular arrangements found were as follows:

1. Adrenal-like cellular arrangement (Fig. 1). In this section there were areas in which the cells were divided into small groups by a very fine fibrous stroma. In general the areas appeared as the zona fascicularis of the adrenal gland. It differed from the latter, however, in that the cells were somewhat larger and appeared more embryonal. The type of cellular arrangement found in these sections was probably due to cutting just above or just below the supporting capillary stroma.

2. Endothelial cellular arrangement (Fig. 2). In the endothelial form we have a cross section of a capillary which was identified by blood and endothelial cells. Extending out from this vessel were several layers of the large polygonal cells arranged in a radiating fashion. The fibrous stroma in this form was very scant, so scant that the cells appeared almost to be growing from the endothelial cells of the capillaries. There was apparently very little difference in the size of the cells which were nearest the vessels and those which were most distant. It was felt that this type was due to a cross section of the cells and supporting capillary stroma.

3. Papillary arrangement (Fig. 3). The papillary form, like the others, was the result of capillary development and the cellular relation. Sections cut in areas in which there was free and close branching of the capillaries always showed papillary form.

4. Alveolar arrangement (Fig. 4). In this type the cells were so arranged with relation to the capillaries that the tissues appeared alveolar. This appearance was due to the cross section of tumor cells surrounded by a capillary loop. In places where this capillary loop was incomplete the tumor cells were arranged in semi-papillary form.

5. Tubular arrangement (Fig. 5). In some areas the capillary stroma was surrounded by a single layer of tumor cells. Alternate parallel single layers of cells and capillaries when cut in cross section have a tubular appearance. The areas in which the arrangement of the cells with respect to the capillary stroma was tubular were due to the parallel distribution of these structures.

In general it may be said from the microscopic studies of this tumor that the extrarenal hypernephromata are made up of large polygonal vacuolated cells resting upon a very irregularly arranged capillary stroma and when cut in different planes show multiple structural forms. The histological findings

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in the extrarenal tumors are the same as the histological findings in the renal hypernephromata.

CONCLUSIONS

1. Tissues other than the kidney are susceptible to cortical adrenal cellular enclosures, especially those which are developed from the mesonephros, mesonephric duct and genital ridge.
2. Primary hypernephromata may develop in any of the tissues or organs in which adrenal rests are found.
3. The predominating cells of the hypernephromata are similar to those found in the normal adrenal cortex.
4. The multistructural formations of the cells in the hypernephromata are due to the plane in which the irregularly arranged capillary stroma is cut.

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SPINDLE-CELLED SARCOMA OF THE KIDNEY IN ADULTS

By HERMAN L. KRETSCHMER, M.D.

OF CHICAGO, ILLINOIS

AND

H. S. RANDOLPH, M.D.

OF PHOENIX, ARIZONA

FROM THE PRESBYTERIAN HOSPITAL OF CHICAGO

THIS report is presented because of the great rarity with which spindle-celled sarcoma is encountered among kidney tumors in the adult. Spindle-celled tumors of the kidney are among the most frequently encountered tumors in children, but their incidence in adults is rare, indeed.

O. Lubarsch has emphasized this fact, basing his opinion on extensive statistics, resulting from the records of 97,498 autopsies, in which there were twenty sarcomas of the kidney, and of these only four classified as spindle-celled tumors in adults. On the other hand, 201 carcinomas were found.

The number of sarcomas recorded in the foregoing autopsies is lower than the number in the report from the Pathological Institute of the University of Berlin for the years 1898 to 1922, when thirteen sarcomas were found in 30,820 autopsies.

CASE.—E. Y. B., male, white, aged fifty-five, was admitted to the Presbyterian Hospital of Chicago, August 24, 1925. He complained of pain and swelling of the left testicle, pain in left side and left lower quadrant of the abdomen, all of which began six weeks ago. He also complained of hemorrhoids. The epigastric distress which occurred immediately after meals, was frequently relieved by vomiting. Loss of twenty pounds in weight in two months, slight frequency in urination, nocturia twice a night for several weeks, fever and perspiration once or twice a week for past five weeks.

Onset and Course.—He stated that he began to feel under par and to lose weight about two months ago. Soon afterwards he experienced aching pains of a mild, dragging character in the left side of the abdomen, especially after walking all day. At the time of his admission to the hospital the pains had been present daily for six weeks. More annoying was the epigastric distress which occurred especially after meals, accompanied by a feeling of fullness that would often cause him to seek relief in induced vomiting. Belching and considerable flatus. Cathartics taken at intervals were followed by severe cramplike pains. Hemorrhoids, which had been removed twenty years ago, recurred in the past six weeks.

Swelling and Pain in Testicle.—Swelling in the left testicle, associated with severe pain, which began five weeks ago and was noticed first only when walking, caused him considerable worry. The swelling and pain became more marked and were more or less constant. The pain radiated to the perineum and anus, but was greatly relieved upon lying down. He was chiefly concerned about being operated upon for what he described as a "painful varicocele," which he had noticed for several months.

Past History.—Patient had always been well and in good health. Has had two attacks of scarlet fever, the last attack at the age of sixteen. Twenty-five years ago had chills and fever—no diagnosis made. Frequent colds during the winter. Twenty years ago hemorrhoidectomy was done and four months ago tonsillectomy. The latter operation was performed because of patient's so-called run-down condition.

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Physical Examination (Dr. Donald P. Abbott).—Eyes and nose normal. There was a stub of tonsil present in left fossa, several crowned teeth with a partial plate and receding gums. Definite apical abscesses on several teeth.

Examination of chest, negative.

Abdomen showed a hard firm mass which was palpable in the left flank, extending up to the ribs, across the midline, and down to a point just below the left anterior superior spine of the ileum. The tumor moved slightly with respiration. A mass of similar consistency, and probably connected with the first mass, was palpable just above the umbilicus. Slight tenderness was present in the right flank; none to fist percussion posteriorly.

The left inguinal ring was found to be somewhat enlarged. A good-sized varicocele was present on the left side, with some swelling and tenderness of the testicle. Rectal examination, negative. Lymphatic System.—Cervical axillary and inguinal glands, not palpable.

Blood Examination.—Red blood cells, 4,080,000; Leucocytes, 12,300; Hemoglobin, 78 per cent.

Differential.—PMN—57. SMN—22, LM—15, T—6.

Blood Pressure.—Systolic 132, diastolic 78. Blood Wassermann—Negative. Blood Chemistry.—Urea, 38; Uric Acid, 5.8; Creatinin, 1.76; Non-Protein Nitrogen, 32.

Urinalysis.—Spec. Grav., 1.014; Albumin, 0; Sugar, 0; Blood +; Pus, +; Sediment, few leucocytes and red blood cells.

Gastric Analysis (Dr. Donald P. Abbott).—Free HCL, 20; combined, 33.

Stool Examination.—Benzidine reaction showed four plus blood.

Röntgen-ray Examination of Stomach.—No constant filling defect. Position of the stomach is well toward the right on the anteroposterior plate.

Fluoroscopy of Stomach.—Negative except stomach apparently displaced to the right.

Cystoscopic Examination. (H. L. K.)—Bladder normal, both ureters catheterized without difficulty or obstruction.

Examination of urine obtained at Cystoscopic Examination:

	<i>Leucocytes</i> per cu. mm.	<i>Cultures</i>	<i>Urea</i>
Bladder	60	Sterile	1.6 per cent.
Right kidney	10	Sterile	1.4 per cent.
Left kidney	10	Sterile	.175 per cent.
Thalein Test:			
		<i>Right</i>	<i>Left</i>
Appearance Time		4 minutes	18 minutes
1st 15 minutes.....		3.0 per cent.	trace
2nd 15 minutes.....		3.8 per cent.	trace
Total		6.8 per cent.	Not readable

Examination of Urine for Tubercle Bacilli.—Negative.

Pyelograms.—Right, normal. Left, only a very small amount of the bromid solution was seen in the region of the pelvis of the kidney, which occurred in the form of a streak. Practically a complete block of the kidney pelvis prevented the bromid solution from entering it.

Diagnosis.—From the findings a diagnosis of malignant tumor of the left kidney was made and operation advised.

Operation (Ethylene Anæsthesia), (H. L. K.), September 11, 1925.—The usual oblique midline incision was made. Muscles divided. Examination showed the presence of a large tumor mass that was firmly adherent to the surrounding structures. The mass was grayish pink in color and moderately firm. The pedicle was about one inch in diameter and was hard and fibrous, with apparently little blood supply. The pedicle was

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clamped with large clamps and the kidney removed. Ligatures were applied and clamps removed. Large tumor masses were seen both above and below the area from which the kidney was removed. They were not removed because of their extent and because of their proximity to the large vessels (involvement of lymph glands).

Post-Operative Course.—Good immediate recovery. The stitches were removed on the ninth day. The wound was completely closed and the patient went home on the eighteenth day. Intermittent temperature up to 102°, rapidly falling to normal and staying down after the fifth day.

Subsequent Course.—The patient gained in strength and his general health improved for several months, then gradually he lost what he had gained. There was an extensive local recurrence of a very large tumor mass. He died in March, 1927. No autopsy obtained.

Pathological Report.—The tumor is large, irregularly oval, the size of a grape fruit, weighing 750 grams and measuring 13 x 9½ x 7 centimetres. It is composed largely of a pale gray, soft, rather elastic tissue through which pass strands of a denser white structure, dividing the tumor into lobules. There are no areas of degeneration, but there is a rather extensive area of hemorrhagic infiltration passing across the centre of the tumor, which shows microscopically to be composed of thin-walled blood spaces. Near the kidney pelvis, the layers of fibrous tissue are pressed together, completely obliterating the pelvic space. Only a small amount of the kidney tissue remained.

Microscopic.—Several different types of tissue are present. There are areas that present the typical picture of a spindle-celled sarcoma, with closely packed spindle cells, running at various angles, and in the high power field numerous mitotic figures, in places six or eight to the field (Fig. 1).

Another picture that is seen is that of a large thin-walled blood space, with a thin stroma and small spindle cells. There are also areas composed of small spindle cells, thinly distributed in a pale staining stroma.

Pathological Diagnosis.—*Spindle-Celled Sarcoma.*—The microscopic character, the size of the tumor, and the clinical course demonstrate malignancy.

The classification of kidney tumors has been very greatly modified, since the introduction and acceptance of Grawitz's theories as to the origin of certain neoplasms of the kidney which now go by the name of "Hypernephroma". Grawitz's work was published in 1883, but Garceau in investigating the subject of renal tumors, twenty-six years later, found that considerable confusion still existed with regard to classification, and his statement made at that time is to some extent still true today. "Carcinoma,

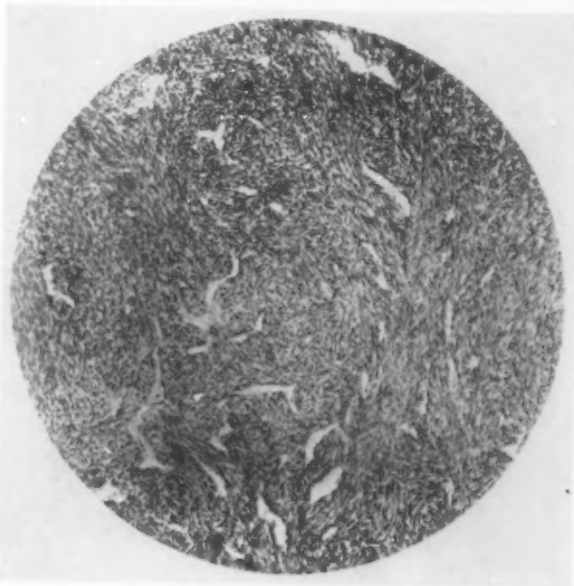


FIG. 1.—A large proportion of the tumor is made up of this type of tissue with intersecting bundles of spindle cells and large vascular spaces.

sarcoma, adenoma, and adenocarcinoma have been persistently and frequently confounded with hypernephroma in the published clinical and pathological reports of cases so as to make nearly all of the material relating to these tumors of little value."

Noticeable has been the diminution in the number of reported cases of sarcoma of the kidney in the adult. Albaran and Imbert reported twenty-one per cent. of 380 cases prior to 1901 as sarcoma. Since that time, the incidence of sarcoma has decreased, and that of hypernephroma has increased.

The tumor most difficult to distinguish from spindle-celled sarcoma of the kidney is the retroperitoneal sarcoma so frequently found behind the kidney or in the position of the kidney, which may easily be mistaken for a kidney

tumor if the pathological data are not complete. Bland Sutton calls attention to this and states, "As far as my experience goes, this is a far more frequent site for them than for those which we term renal sarcoma." The case reported here is an excellent example of this difficulty, as the tumor has almost completely replaced the kidney.

The point of origin of these tumors is difficult to establish. In six of the collected cases, no point of origin was stated in the reports. Two were definitely

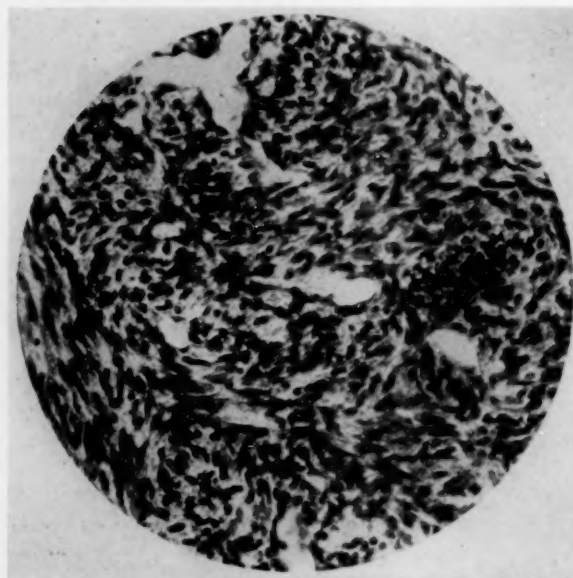


FIG. 2.—Higher magnification showing several mitotic figures.

from the kidney pelvis, and two from the capsule. Boyd states "True sarcomas, round or spindle-celled, probably always arise in the kidney capsule from which they invade the kidney." Bland Sutton is somewhat of the same opinion, and calls attention to the fact that sarcomata of viscera having similar coverings—spleen, thyroid, prostate, etc., while uncommon, are often closely connected with the connective tissue investing the organ.

Symptomatology.—Age incidence. All except one of these case reports are of patients of thirty-seven years or over. The youngest was twenty-four and the oldest sixty-eight years of age.

Hematuria was present in only three, absent in five and probably absent in the three cases in which it was not mentioned. Red blood cells were reported in the urine of only two of the cases. It seems most reasonable to expect hematuria to be frequently absent in tumors developing from the capsule, but generally present in those of stroma and epithelial origin.

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Varicocele and hemorrhoids were the most troublesome symptoms in the case reported here—developing rapidly in six weeks' time. Braasch, in 1913, found varicocele in ten out of thirty cases, and hemorrhoids of recent origin in five cases. Varices of the bladder were present in four out of fifty cases. Williams reported thirty-six cases of kidney tumors in adult males—with three varicoceles. This series consisted largely of hypernephromas.

Guyon, in 1881, first called attention to the "symptomatic" varicocele as being of special significance and most often caused by kidney tumors, "independent of involvement of the paravertebral lymphatics."

Loss of weight was present in six, absent in one, and not reported in four of the reported cases.

The tumor was felt by the patient before admission in six cases, not felt in one and not reported in four. Right kidney involved in six cases and the left in six.

Cystoscopy was performed in only two cases, but in the rest, the diagnosis did not appear to be the question. One case was diagnosed ovarian cyst, however, before operation.

Inflation of the colon for diagnostic purposes was practiced in only one of these cases.

The pre-operative diagnosis of sarcoma of the kidney as differentiated from the other types of kidney tumor, is practically impossible. A diagnosis of tumor is simple enough but there is no symptom or sign that justifies making a diagnosis of sarcoma, particularly if we bear in mind the great rarity of these tumors in the adult.

SPINDLE-CELLED SARCOMA

Symptoms

1. Cassell, female, aged forty-nine, hematuria, +; pain, L; loss of weight, +; œdema or varicocele, abd.; constipation, +; tumor felt by patient, +; palpable tumor, L; urine, abd. pus; operation, L. nephrectomy; result, not stated.

2. Chifoliau et Masson, female, aged forty-six, hematuria, NS; tumor felt by patient, +; palpable tumor, +; operation nephrectomy; origin of tumor, vascular; result, not stated.

3. Eliot, male, aged fifty-five, hematuria, +; pain, L; palpable tumor, L; urine, blood; cystoscopy, both ureters catheterized, no urine from left, discharge of blood from left, right normal; operation L. nephrectomy; origin of tumor, kidney pelvis; result, good recovery.

4. Heuston, female, aged twenty-four, hematuria, +; pain, +; tumor felt by patient, +; palpable tumor, R; operation R. nephrectomy; origin of tumor, pelvis involved many cysts of parenchyma; result, uneventful recovery.

5. Kretschmer and Randolph, male, aged fifty-five, hematuria, O; pain, L; gastric disturbance, +; loss of weight, +; œdema or varicocele, varicocele; hemorrhoids, +; palpable tumor, L; urine, pus blood; cystoscopy, bladder normal—both ureters catheterized; pyelogram, left showed conformity compatible with tumor; operation, L. nephrectomy; result, died one year seven months following operation.

6. Picque, female, aged forty-five, hematuria, O; pain, R; palpable tumor, L; urine, alb.; operation, L. nephrectomy; result, not stated.

7. Rabe et Morel, male, aged fifty-four, hematuria, O; pain, L; œdema or varicocele, œdema legs; palpable tumor, L; operation, died nine days after admission to hospital

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and before operation; origin of tumor, autopsy: almost complete destruction of kidney, many cysts containing hemorrhagic fluid; result, died nine days after admission.

8. Ralphs, female, aged thirty-nine, hematuria, O; pain, R; tumor felt by patient, +; palpable tumor, R; operation, R. nephrectomy; origin of tumor, pelvis (?); result, died few minutes following operation.

9. Reisterer, female, aged sixty-eight, hematuria, NS; loss of weight, +; œdema or varicocele, œdema ankles, eyelids, abd.; tumor felt by patient, + palpable tumor, R; operation, R. nephrectomy; result, died eleven days following operation.

10. Reisterer, female, age, NS; hematuria, NS; pain, R and L and abd.; loss of weight, +; constipation, +; palpable tumor, mass diag., ovarian tumor; operation, R. nephrectomy; origin of tumor, "found in the retroperitoneal position in right kidney region" from kidney capsule; result, not stated.

11. Schwartz, female, aged fifty-four, hematuria, O; pain, +; œdema or varicocele, abd., varices left leg; constipation, +; tumor felt by patient, +; palpable tumor, R; operation, R. nephrectomy; origin of tumor, fibrous capsule right kidney; result, complete recovery.

CONCLUSIONS

1. A case of spindle-celled sarcoma in an adult is reported.
2. The statement, that this is a relatively rare type of tumor of the kidney, seems justified.
3. A pre-operative diagnosis of tumor, probably hypernephroma, was made in this case.
4. A clinical or pre-operative diagnosis of sarcoma is practically impossible.

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CONGENITAL ABSENCE OF ONE KIDNEY

UNILATERAL RENAL AGENESIS

By MEREDITH F. CAMPBELL, M.D.

OF NEW YORK, N. Y.

FROM THE DEPARTMENTS OF PATHOLOGY AND UROLOGY, BELLEVUE HOSPITAL

CONGENITAL absence of one kidney is most often an autopsy finding. When the lesion is recognized during life, it is usually only after disease and frequently extensive destruction of the solitary kidney has been proven. The condition, therefore, is of great importance and interest to the surgeon performing operations on the urinary tract. We are herewith presenting a clinico-pathological study of nine cases of complete unilateral agenesis of the kidney as found in 13,000 autopsies at Bellevue Hospital and one case presumably of this character observed clinically. While renal aplasia or incomplete development may be equally important clinically and is four times more frequently observed, we are not concerned here with this anomaly.

Fortunately, unilateral renal agenesis is not common. In this series the incidence is one in every 1,444 cases. Anders¹ in 1910 found the ratio to be one to 1,817 in 92,690 autopsies. Adding to this number our 13,000 autopsies and others reported since 1910, totalling 122,320 autopsies, we find an incidence of one in 1,610 cases.

EMBRYOLOGY

The failure of the Wolffian duct to give off a renal bud after the duct has reached the cloaca is the embryological explanation of unilateral renal agenesis. In some cases a rudimentary ureter represented by a fine fibrous thread or a partially patent tube is found leaving the bladder at the normal ureter exitus, but this aplastic ureter usually disappears some distance below the kidney region. Non-development of nephrogenic tissue is the probable explanation of such a finding. There are often associated genital anomalies. This is particularly true in females, and results from defective Mullerian duct development. In one of our cases there was marked aplasia of the female generative organs isolateral with the renal absence; in another, there was isolateral aplasia of the male seminal tract.

CLINICAL CONSIDERATIONS

Unfortunately there are no pathognomonic signs or symptoms of unilateral kidney. Urinary frequency, pyuria, and occasionally anuria have prompted most urological examinations revealing congenitally absent kidney. In none of our autopsy series was the condition suspected during life. Physical examination gave no clue suggesting unilateral kidney and in but

TABLE I.

Case	Age	Sex	Side	Adrenal	Renal vessels	Ureter	Bladder	Genitalia	Principal disease	Remaining kidney
1. M. S.	1 mo.	F.	L.	Absent	Absent	Absent	No dimple	Unicorn uterus, no left Fallopian tube, atrophic ovary	Marasmus	Normal
2. R. T.	5 da.	F.	L.	Not recorded	Absent	Absent	No orifice	Unicorn uterus, suprapelvic left ovary. Perineal maldevelopment.	Pneumonia	Normal
3. A. C.	36 yr.	F.	R.	Absent	Absent	Fibrous thread to retroperitoneal fat	No orifice	Grossly normal	Carcinoma of breast	Ureter and kidney dilated without obstruction. Kidney large and flabby.
4. S. Y.	36 yr.	M.	R.	Absent	Absent	Absent	No dimple	Rt. testicle atrophic retroperitoneal. Rt. seminal vesicle and vas deferens atrophic. Verumontanum opens on urethral floor. No elevation.	Pneumonia	Normal
5. K. M.	35 yr.	M.	L.	Absent	Absent	Absent	No orifice	Grossly normal	Uremia	Scarred kidney of nephritis
6. J. F.	40 yr.	M.	L.	Not recorded	Absent	Absent	No orifice	Grossly normal	Pulmonary tuberculosis	Hyperplastic
7. C. J.	69 yr.	M.	L.	Not recorded	Absent	Absent	Dimple	Grossly normal	Pneumonia	Hyperplastic
8. M. M.	54 yr.	F.	R.	Not recorded	Absent	Absent	Dimple	Grossly normal	Endocarditis	Multiple infarction. Left kidney much enlarged.
9. S. M.	1 yr.	M.	L.	Not recorded	Absent	Absent	Dimple	Grossly normal	Uremia	Acute focal suppurative nephritis.

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three instances—those patients dying of renal failure—did urinalysis indicate nephropathy. In a few cases reported by others loin pain on the affected side has been present.

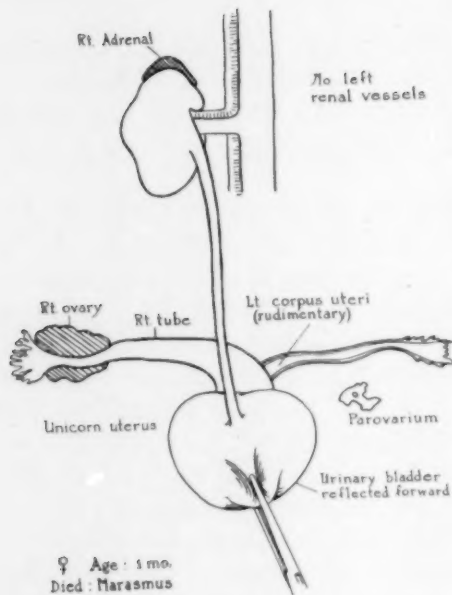
In some of this latter group the diagnosis was made only at operation. The surgical import of this condition has been forcibly stressed by Ransahoff,² who in 1912 collected eleven cases in which, unknowingly, the only kidney had been removed or otherwise surgically incapacitated (nephrotomy, etc.). All died promptly of uremia.

Careful cystoscopic examination and the liberal use of indigo-carmin intravenously are perhaps of greatest diagnostic aid. When the dye is employed, the patent ureter should of course be plugged with a large catheter. Ectopic or extravescical ureteral openings, particularly into the urethra or vagina, must not be overlooked. Plain röntgenograms do not always assist, but may do so in a negative way when they indicate the presence of a probable kidney shadow on the suspected side. It must be borne in mind too that occasionally crossed dystopia with renal fusion occurs, as observed in an autopsy at Bellevue some time ago. The fused kidney was found on the right side but showed two ureters emptying into the bladder in normal positions. In such a case plain röntgenogram would suggest an absent left kidney, but pyelography would indicate the character of the anomaly. Occluded renal tuberculosis has been confused with renal agenesis and aplasia. Inability to find a ureteral orifice or to pass a ureteral catheter is in itself, of course, inconclusive evidence of renal absence.

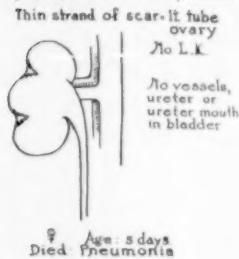
CASE 10.—C. C., aged six years, admitted because of freely movable mass in right lower quadrant without pain. Urine showed many pus cells. Total phenolsulphone-phthalein output 35 per cent. in two hours. Plain röntgenogram showed no evidence of left kidney, right kidney shadow lower than normal but of normal size. Cystoscopy reveals no left ureter orifice; catheter passed up right ureter easily to kidney pelvis, obtaining a hydronephrotic drip. Indigo-carmin intravenously appeared in deep concentration from the right side in six minutes and with this catheter firmly plugging the orifice, no blue was seen to enter the bladder, urethra, vagina, nor did any appear in the rectum. Pyelogram revealed a dilated ureter and right kidney, moderate ectopy and no evidence of left renal shadow. The indigo-carmin test was repeated twice subsequently and never was evidence of another ureteral opening obtained. While renal exploration of the left side was not performed and this case therefore lacks the final proof of the others here reported, we feel confident that we are dealing with the same type of case, certainly of marked aplasia if not actually agenesis of the kidney.

Age.—This is a factor of comparatively little importance. Just as many nephrectomized patients live the normal span of life, so may those congenitally allotted but one kidney enjoy a fair life expectancy. However, we found that a third of the autopsy cases of this series died with renal failure. Our youngest was five days of age; our oldest patient was sixty years of age.

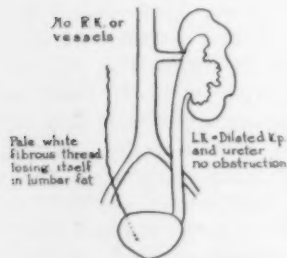
Sex.—We do not know why the incidence should be greater in the male. Statistical study reveals this to be apparent, but it has been suggested that more autopsies are performed on males. This seems to be the likely explanation as there is no embryological interpretation. Five of our cases were males, five were females.



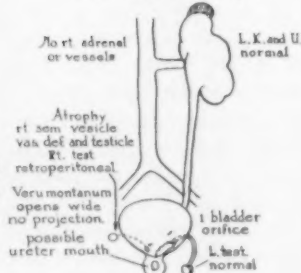
Patent interventricular septum
patent foramen ovale
patent ductus arteriosus
agenesis of aortic ostium
uterus unicornus
suprapelvic left ovary
deformity of ears
perineal maldevelopment



Died: Ca breast 38 yrs. ♀



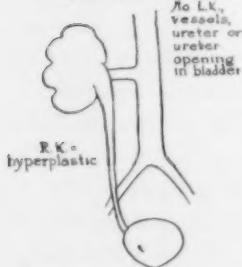
Died: Pneumonia 36 yrs



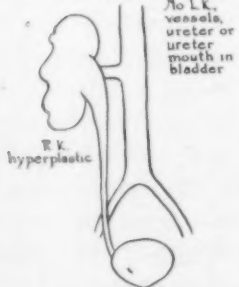
Died: Uremia (pneumonia) 35 yrs.



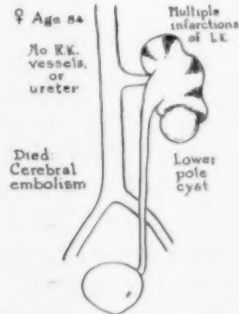
Died: Pulm. tbc. 40 yrs.



Died: Pneumonia 60 yrs



♀ Age 54



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Side Involved.—Here again an inexplicable predisposition apparently exists. The left side is involved considerably more often than the right. In our series agenesis occurred on the left side six times, on the right side three times and once the solitary kidney (not a fusion) was found in the midline somewhat to the right side. Approximately this ratio has been noted by others.

Adrenal.—This organ was absent on the involved side four times; it was not described in five cases. It was recorded as normal on the side of the solitary kidney in all cases. Absence of the adrenal probably results from isolateral vascular agenesis.

Renal Vessels.—Renal vessels were not found in seven cases and in two instances their presence was not recorded. If evidence of renal vessels is found, one should examine particularly carefully for indications of a degenerated kidney—a cystic or fatty mass in the site of the normal kidney. In a series of thirty-nine cases of renal aplasia which we are reporting elsewhere, a few fall within this degenerative type and unquestionably would be overlooked did not the atrophic vascular supply give the clue. Clinically, of course, this point is of no moment.

Ureteral Agenesis.—In but one of our cases was there evidence of ureteral budding. A fibrous thread left the bladder at the normal exit but was lost in the lumbar retroperitoneal fat. There was no lumen and a dimple only was present at the normal ureteral orifice. A normal-sized ureter, particularly if patent, should cause one to seek zealously for the remains of a degenerated kidney. Ball³ reported a case in which such a ureter became a huge cystic mass, bringing the patient to operation.

Bladder.—In none of our cases was a ureteral opening present on the affected side; a dimpling was seen in four cases, however. The appearance of the trigone was not recorded. Some observers have noted absence or hypoplasia of the trigone with absence of the ureteral orifice.

Genitalia and Reproductive Organs.—Aplasia or agenesis of these structures is occasionally associated with renal agenesis. A unicorn uterus with most rudimentary ovary and Fallopian tube was found in two instances. In another, the testicle on the involved right side was retroperitoneal and atrophic. The right seminal vesicle and vas deferens were likewise atrophic. The character of the epididymis was not recorded. The verumontanum did not project as normally, but was represented by a deep depression on the floor of the urethra. Others have noted the complete absence on the same side of the prostate, epididymis, vas deferens, seminal vesicle and ejaculatory duct. In females, the uterus has been found absent in some cases and vaginal anomalies have been present. In seven of our nine autopsy cases the genitalia were normal.

The Solitary Kidney.—Perhaps the greatest clinical interest focuses on solitary kidney. The burden thrown on this organ is frequently overwhelming and at autopsy in three of our cases a destroyed kidney was found. Once there was generalized infarction, once acute suppurative focal nephritis,

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and in a third a typically scarred kidney of chronic interstitial nephritis was seen. All died of uremia.

The organ was hypertrophic in three cases and apparently normal in three. Marked dilatation and infection of the ureter and kidney pelvis was found in two instances. In the first, an adult, there was no obstruction; in the second, an infant of one year, a dense ureteral stricture was present 1 cm. above the bladder. The former died following an operation for carcinoma of the breast; the infant died of uremia. Ectopia of the solitary kidney has been noted, the kidney having been found in the pelvis in some cases, in the abdominal cavity in others. In one of our cases, the kidney was in the midline, the ureter coursing down and emptying into the bladder near the midline. In another, a child of six years observed clinically, the single kidney was freely movable about the right lower quadrant and showed moderate hydronephrosis, ureteral dilatation and infection. A predisposition to calculus formation in solitary kidneys has also been observed. In our series no stones were found.

SUMMARY

Although unilateral renal agenesis occurs but once in approximately 1,600 individuals, the condition is not infrequently encountered by urologists. A left-sided incidental preponderance has been noted. As a rule there is no suggestion of the lesion until urinary signs and symptoms arising from the diseased solitary kidney instigate a complete urological examination. The condition of the solitary kidney merits our greatest concern. Often palliative measures only can be employed because of the advanced renal injury. Of the nine cases here reported and proven by autopsy to have but one kidney, three died of renal failure.

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KIDNEY RESECTION

BY ALBERT J. SCHOLL, M.D.

OF LOS ANGELES, CALIF.

RECENT literature on renal surgery indicates that surgeons are recognizing the value of conservative surgical procedures on the kidney.

In the early days of renal surgery nephrectomy was fraught with much uncertainty and high mortality, and only rarely done. When it was found that incisions might freely be made in the kidney substance and that they healed readily, resection or partial nephrectomy was attempted. This operation showed a much lower mortality than nephrectomy and consequently, for a short period of time, it was considered a more desirable surgical procedure. The fragment of kidney not removed usually healed promptly and preserved a portion of functioning tissue.

Historical.—As early as 1886, only a few years after nephrectomy had become an established operation, Czerny¹ removed a portion of a kidney following trauma. This was really an emergency procedure, but the following year he did the first deliberate resection of a kidney, removing the lower pole, which contained angio-sarcoma; in 1889 he carried out three further resections. At about the same time Kümmell² also resected a segment of a kidney for stone and abscess.

Von Schmieden,³ in 1901, collected reports of thirty-four cases of resection in 2,100 kidney operations. In 1,118 total nephrectomies there was a mortality of 27 per cent. Only four (11.8 per cent.) of the patients in the thirty-four partial nephrectomy cases died. Moynihan,⁴ in 1902, reported two cases of resection of the kidney, one for cyst and the other a case of excision of half a kidney for myxosarcoma. In both his cases a wedge of kidney substance was removed and the wound was closed by interrupted catgut sutures. Henry Morris⁵ reported a case in which one kidney was removed for tuberculosis; later one-third of the remaining kidney was excised. The patient was well five years after the latter operation. A similar case was reported by Papin.⁶

Berti⁷ collected reports of 112 cases of resection of the kidney from the literature up to 1921. Eighty-six recovered and eleven died. The outcome was unknown in fourteen. A total nephrectomy was necessary later in seven cases and a fistula persisted in five. The total 112 cases included five of cancer, with two cures; fifteen of tuberculosis, with seven cures; fifteen of simple hydronephrosis, with fourteen cures, and eighteen of horse-shoe kidney, with twelve cures.

How Much Kidney Substance Is Necessary to Support Life?—The work of Tuffier⁸ thirty years ago, and that of Bobroff⁹ later, demonstrated that life could be supported on a very small portion of a normal kidney. Tuffier,

in his experimental work, did a total unilateral nephrectomy plus more or less extensive resections of the other kidney in an endeavor to find exactly the quantity of normal kidney tissue necessary for the maintenance of life. He found that there was a definite regeneration of tissues in the remaining segment if the portion allowed to remain was sound, otherwise not. Tuffier's work formed the basis of his later "morcellement" nephrectomy. Paoli¹⁰ showed by his experiments that if one-half of one kidney was excised, and, after an interval, the whole of the opposite kidney removed, the remaining half sufficed to maintain life. Very probably in these cases, where only a small portion of renal tissue remains and where there is a demand for an increased amount, regeneration takes place. Stoerk¹¹ described two methods of new formation of renal parenchyma, one by the elongation and winding around of normally present tubules, the other by ramifications due to new budding. Simpson¹² demonstrated that the epithelium of the tubule is capable of proliferation and that small losses in the tubular epithelium are quickly replaced. When there is a demand for compensatory hypertrophy in the remaining renal tissue its beginning is indicated as early as the third day.

The Sequelæ of Kidney Resections.—Results were not completely satisfactory following partial nephrectomy. Owing to difficulty of approach and insufficiency of drainage, fistulæ formed and occasionally secondary total nephrectomies were required; only 58 per cent. of von Schmieden's³ thirty-four collected cases healed. Besides, better results were being obtained with total nephrectomy; the surgical technic for the removal of kidneys was more satisfactory and the operative mortality was distinctly lower. Nephrectomy became the operation of choice in malignant, tubercular and other infectious conditions of the kidney, and for a period of twenty years virtually nothing was reported concerning partial nephrectomy. In the rare cases that partial nephrectomy was performed, it was usually, but not always, done for various non-malignant, non-infective conditions such as cysts, large, benign tumors, and painful or distorting renal anomalies.

With the improvements that have been made in recent years more satisfactory methods of approach are being employed and external incisions, such as the postero-lateral, are made that permit visualization of the entire field of the operation. Consequently, as it is sound surgical practice not to remove any tissue capable of functioning, the more highly technical conservative procedures are again being attempted and, as shown by Judd,¹³ Hinman,¹⁴ and Caulk,¹⁵ the trend of modern renal surgery is toward conservation.

Judd¹³ considers that localized infections are amenable to resection. Although the surgical technic is not yet sufficiently perfect to prevent the formation of sinuses from calices or pelvis, yet these, when they occur, heal promptly. The important thing is that the sound stump of kidney left behind must be assured of an adequate blood supply before the vessels of the diseased part are clamped. After suture the area of resection is covered by a portion of the fatty capsule.

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The experimental work of Perlmann and Kairis¹⁶ showed that simultaneous resection of both kidneys, or simultaneous nephrectomy and resection, were the most fatal types of procedures; in non-simultaneous operations on both kidneys the results were good.

The work of Hinman¹⁴ has shown us that if one kidney is doing all the work, it would be inadvisable to conserve a portion of the opposite apparently functionless kidney. The conserved fragment would have no stimulus to function and might even later require removal or at best become completely atrophied.

Illustrative Case.—The following case is one in which both kidneys were diseased. It was necessary to remove a portion of one kidney containing stone; resection was done, conserving a fragment of kidney which, after operation, was equal in functional value to the non-operated kidney.

A woman, aged twenty-nine, married and having one child aged two, came for relief of pyuria and pain in the region of the left kidney. At sixteen years of age, following three attacks of abdominal pain, her appendix had been removed and at the age of twenty-six a plastic operation was done on her left ovary.

Present Illness.—Fourteen months ago she first had a sense of dragging and discomfort in the left loin. This condition, having once become established, was very persistent and was often associated with marked urgency of urination. Usually there was no frequency or dysuria. Occasionally she noticed that her urine was bloody, and most urinary examinations revealed microscopic blood and pus. She had lost about six pounds during the last year and now weighed ninety-four pounds.

Both kidneys were palpable; the left was enlarged and tender. The urine contained albumin, pus and blood, and the combined intravenous two-hour phthalein return was 65 per cent. The X-ray revealed several shadows in the region of the left kidney. There was one main shadow about 3 cm. in diameter; this connected to a smaller shadow by means of a narrow isthmus; the entire mass was deemed to be a calculus which resembled a dumb-bell. Several centimetres below this there was a crescentic shadow about 2 cm. in length. (Fig. 1.)

Cystoscopic Examination.—Cystoscopy revealed a mild cystitis. Both ureteral orifices were normal in location and appearance. Clear spurts of urine were being ejected from each ureter. Both ureters were easily catheterized. Specimens of urine from the left kidney contained pus, red blood cells and bacteria. The urine from the right kidney also contained bacteria and a few pus cells. The cultures from both kidneys were positive for colon bacilli. Intravenous phthalein returned from the right kidney after three minutes and drained 8 per cent. in fifteen minutes; it appeared after five minutes from the left kidney and drained 7 per cent. in the same time.

At a later cystoscopic examination intravenously injected indigo-carmin returned from both ureteral orifices after five minutes; that from the left, one, and that from the right, two, on a scale of one to four.

Operation.—Under gas and oxygen anaesthesia the left kidney was exposed through a postero-lateral incision; it was almost twice normal size. The lower pole was rounded, bulbous and oedematous, and there were extensive inflammatory, perirenal adhesions. After stripping off the adhesions, the lower segment of the kidney was about 6 cm. wide; it felt hardened but readily compressible and somewhat fluctuant. The fatty covering over the pelvis was removed and a 2-cm. incision made in the renal pelvis parallel to the long axis of the kidney; this readily exposed the main segment of the calculus, which was removed through this incision. The handle or middle section of the dumb-bell-shaped stone projected through the lower calyx where the smaller, rounded mass completely blocked the drainage from the lower pelvis. It was impossible to remove the

stone in one piece, so it was broken and the larger part removed through the incision in the pelvis. The other fragment of the stone slipped back into the lower part of the kidney. (Fig. 2.) When the lower end of the stone slipped away from the calyx, thick, green pus oozed up through the opening, showing that there was pus under pressure in the lower renal segment and that it was confined there by the ball-valve action of the stone. A transverse incision was then made in the parenchyma of the kidney in an area where apparently normal tissue adjoined the swollen lower segment. The incision opened into the abscess cavity, which contained about three ounces of thick, green pus. The

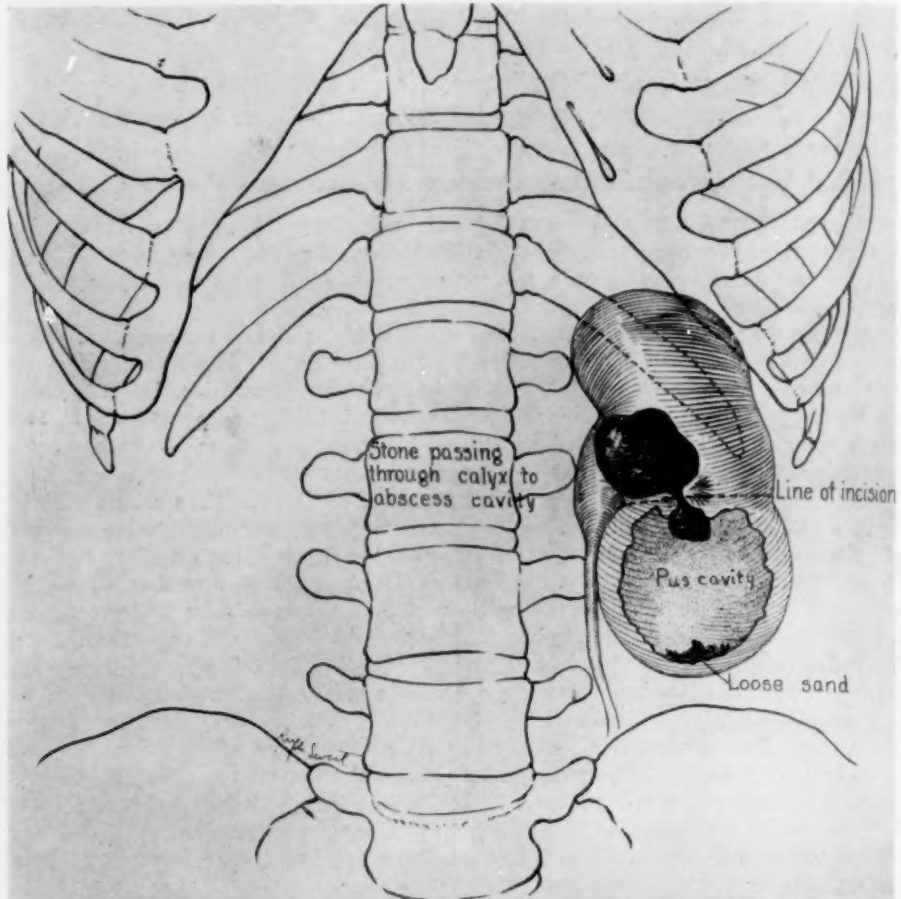


FIG. 1.—Composite drawing made from X-ray and operative findings. Smaller segment of stone completely blocking the lower calyx.

wall of the cavity, which comprised the entire lower third of the kidney, was thin, fibrous and contained very little functioning tissue. The lower segment of the kidney containing several fragments of stone was resected. The incision in the kidney was closed with two layers of No. 1 catgut. A soft open-end rubber catheter was inserted through the opening in the renal pelvis down to the line of incision. Several stitches of fine catgut were taken in the fat overlying the pelvis which partially closed the incision in the pelvis. (Fig. 3.) Two soft rubber drains were placed down to the line of incision in the kidney.

Post-operative Course.—The catheter drained urine very freely for eight days after the operation and the temperature varied around 100° and 101° F. On the tenth day the temperature was 99° and the catheter was removed; after twenty-four hours no further

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urine came from the incision. The drains were removed several days later and the wound healed. The patient recovered rather slowly from the operation and quite frequently had an evening temperature of 99° or 100° F. Two months after the operation she suddenly developed a fever of 102° F. and a painful palpable mass was felt in the left loin.

Cystoscopy with a left ureteral catheterization was done; 30 c.c. of infected urine

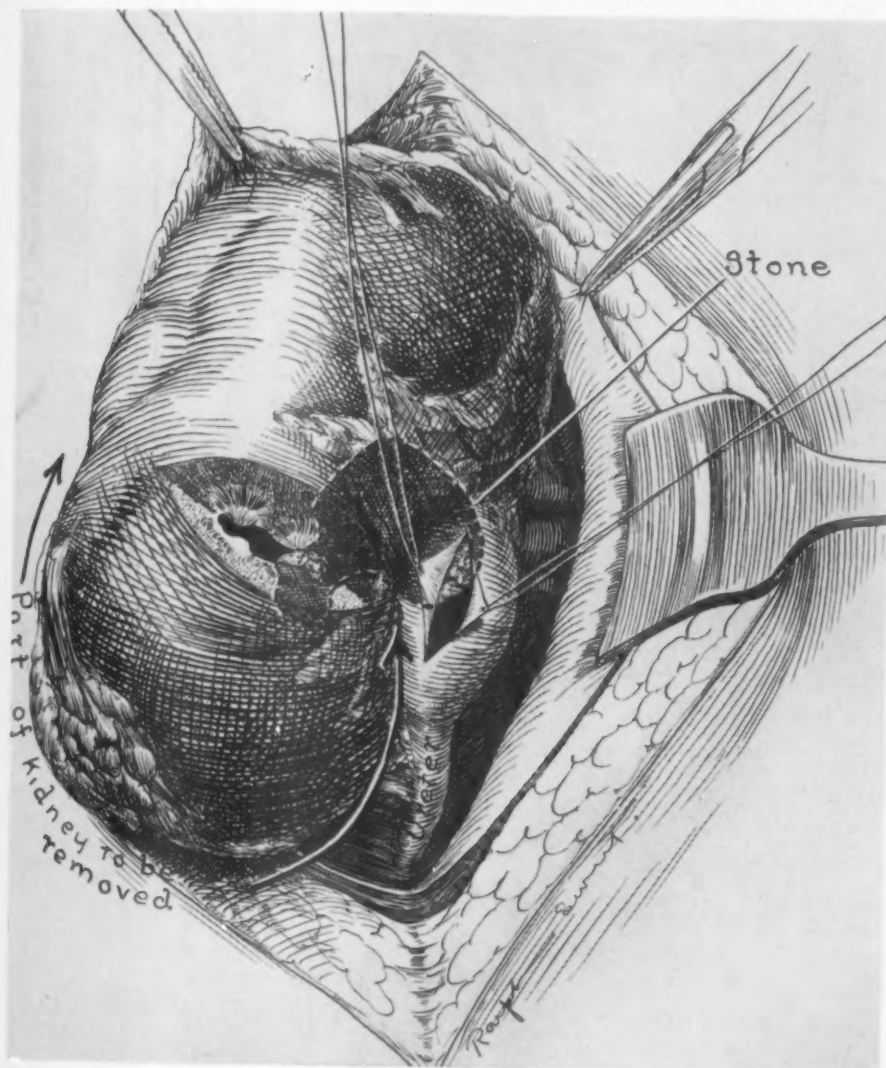


FIG. 2.—Resection of lower portion of kidney. Larger fragment of stone removed through pelvis; the smaller piece was removed with resected lower pole of kidney.

was removed and the pelvis washed out. The temperature remained elevated, so a ureteral catheter was re-inserted and left in place for four days; following this the temperature returned to normal and the mass and left-sided pain disappeared. During the next two months the temperature varied from normal to 102° F. The patient was cystoscoped twelve times. On some occasions merely a simple pelvis lavage was given, on others the catheter was left in place several days. Almost invariably ureteral catheterization caused the temperature to return to normal at least temporarily. Four months after operation the temperature was normal and the urine from both kidneys was free

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from pus or bacteria. Nine months after operation a divided intravenous phthalein test revealed a normal and equal function in both kidneys (14 per cent. of intravenously injected phthalein returned from each kidney in fifteen minutes with three-minute appearance time). Sixteen months after operation the bladder urine was not abnormal and the patient had gained sixteen pounds and was feeling in splendid condition.

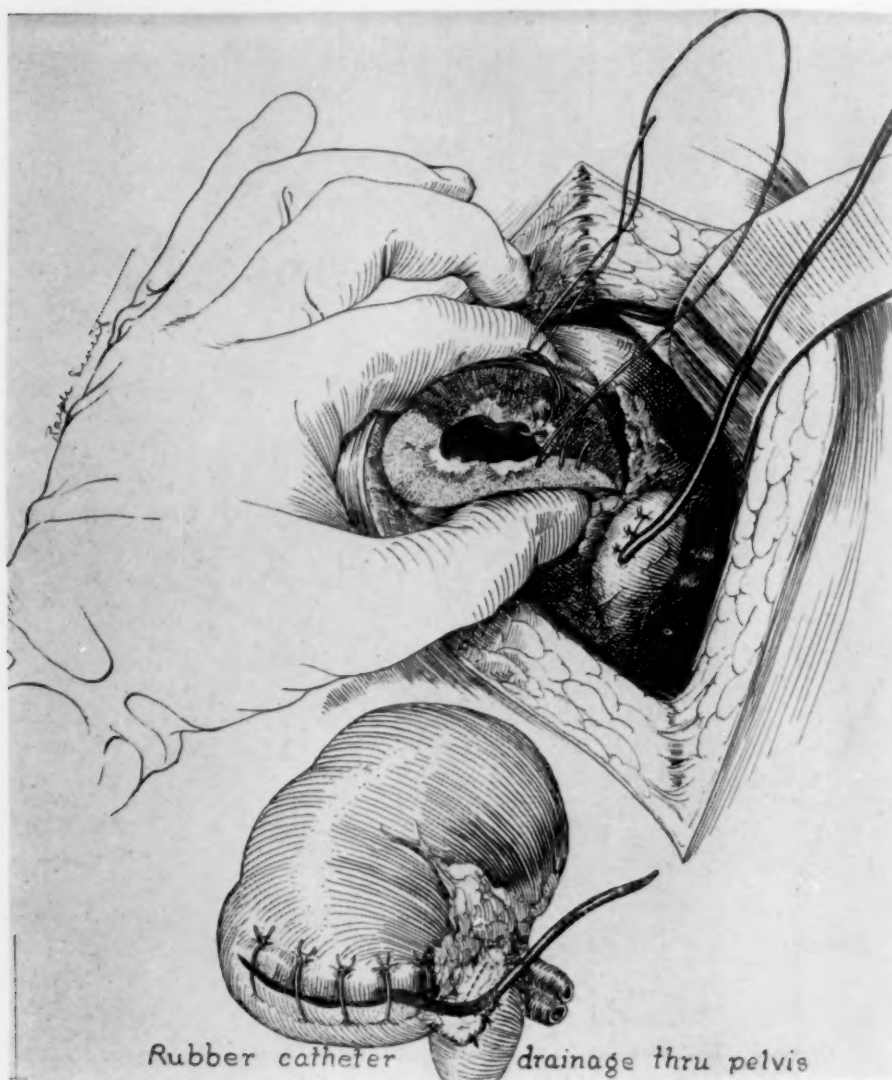


FIG. 3.—Area of resection closed with two rows of sutures. Fatty flap covers incision in pelvis.

Comment.—In the above case a bilateral pyelonephritis was present with a reduction of functional efficiency of both kidneys. It is an example of the results that may be obtained with persistent care and unremitting treatment. At several times during the convalescence the pain, high temperature and evidence of severe infection suggested that the remaining fragment of kidney should be removed. On the other hand, the divided phthalein test indicated

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that the left kidney, though having a reduced function, was of as much, or possibly more, functional value than the right kidney, in spite of the presence of the stone. The phthalein return from a kidney containing a stone does not give an accurate index of the amount of functioning tissue present; usually it suggests much more destruction than is actually present. Consequently, in this case, with infection in both kidneys and with a function in the abscessed kidney equal to that of the other kidney, a conservative operation was indicated. At operation, when it was found that a portion of the kidney must necessarily be removed, a resection was carried out.

SURGICAL TECHNIC AND INDICATIONS

Partial nephrectomy is a more difficult procedure than a simple nephrectomy. Obviously it would be unwise to remove a portion of a kidney if the opposite kidney were doing all the work. The remaining segment having no stimulus to regenerate would, as Hinman¹⁴ pointed out, probably atrophy and would either necessitate a later nephrectomy or it would remain as a source of infection for the entire urinary tract. Kidneys infected with tuberculosis should not be resected. In a series of removed tuberculous kidneys microscopic studies were made of the tissue adjacent to the infective foci. Even in kidneys in which the lesion was apparently well walled off and grossly suitable for resection, isolated tubercles were found in the adjacent tissues and occasionally in areas well away from the infected portions.

In simple infective cases, either complicated by stone or not, partial nephrectomy should not be done unless the pathologic condition is confined entirely to a localized area of the kidney. It is necessary to remove all the diseased tissue and leave only a normal functioning segment. The incision should be made through sound tissue, even though it is necessary to sacrifice a small portion of the remaining or normal segment. If the incision is carried through an infected area, the infection may be carried by surgical manipulation and rapidly invade the normal tissue; also the infected areas of the parenchyma are usually thinned out and friable and do not suture well nor heal normally.

Fistula formation was the *bête noire* of parenchymal incisions and partial nephrectomy in the early days of renal surgery. Almost invariably in these earlier cases the wounds were packed extensively with gauze, both to aid healing and to control hæmorrhage. Consequently fistulous tracts were common. At present urinary fistulæ are rarely seen, as gauze packing is only used in parenchymal incisions in emergencies.

In cases where a resection is performed to remove an infected segment, even though the incision is made through apparently sound tissue, a local fibrosis is generally present. Consequently, hæmorrhage is usually of small amount. An inner suture of continuous catgut will in most cases readily control any internal bleeding and a second suture approximates the parenchyma and serves also as a hemostatic suture. Several interrupted through-and-through catgut sutures are placed through the renal stump for added

safety and they also aid in approximating the two walls of the kidney. The incision should then be covered over with a flap made from adjacent fatty tissue in a similar manner, as is usually done to cover pyelotomy wounds. If possible, in removing the diseased segment, the incision is made so as to remove a wedge of tissue which permits a more accurate closure of the remaining segment.

The healing process resulting after resection was clearly shown in the segment of one kidney which was subsequently removed. The resected surface, though pitted in some areas, was smooth and had assumed the normal rounded contour of one of the renal poles. The pathologic process had involved only the tissues immediately adjacent to the line of incision.

In an occasional case partial nephrectomy may be the only operation permissible. The opposite kidney may have been removed at a previous operation or it may be functionless. This makes it essential to conserve as much functioning tissue as possible. Judd¹³ removed a functionless right kidney from a young woman. The left contained a localized pyonephrosis and stone. At a second operation the diseased area including the stone, which comprised about one-third of the kidney, was resected. Studies of blood urea and renal function have been made at regular intervals since the operation. Three months after operation the urea content in the blood was normal and has since remained unchanged. The fact that this patient went safely through a pregnancy and is now well four years after operation indicates, as has been shown by animal experimentation, that even a part of one kidney is sufficient to maintain life.

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SUPERNUMERARY ECTOPIC URETERS

BY WILLIAM M. SPITZER, M.D.

AND

IVAN E. WALLIN, D.Sc.

OF DENVER, COLORADO

THE object of reporting this case is threefold: (1) to report an extremely rare condition, (2) to attempt to classify this anomaly into two types, and (3) to justify and further confirm the treatment which has recently been advocated.

CASE REPORT.—Miss H. S., age twenty, referred by Dr. Josiah N. Hall, January 19, 1926, with the following statement:

The patient consulted him on account of pain in right upper quadrant of abdomen, together with seeming discharge from the vagina, and an inflammation of the vagina accompanying the discharge. Doctor Hall referred the patient with the statement: That there was a constant watery discharge from the vagina, which had an inflamed appearance. There was a marked tenderness in the upper quadrant of the abdomen, which tenderness he attributed to a hydronephrosis. He further reported that the patient's pelvis was negative, as were the head, neck, and abdomen (except for the condition mentioned) and that there was nothing further noteworthy.

Family history is negative, except for the fact that she has one sister who menstruated at the age of three months and has menstruated regularly and normally ever since, now being the mother of a family. The patient gives a history of the usual diseases of childhood, with no complications and no illnesses since. Her menstrual history is that of a normal woman. She states that as a child she was whipped for bed wetting and for wetting her clothes during the day. The patient relates that, with the exception of a year (at about the age of eight) she has always been unable to hold her water very well. The amount of leakage was so little, ever since she could remember, that it could be very easily taken care of by one napkin or one cloth per day or night. Furthermore, the condition has been of very little annoyance to her until recently when she began to have pain in the right side and when the discharge began to irritate the vagina. Despite this incontinence, micturition was normal as to frequency and amounts voided and the act was physiologically perfect.

The patient is a well-developed woman wearing a napkin which is but slightly moistened, although it has been *in situ* for seven hours. Concurring with Doctor Hall, tenderness is found in the upper right abdomen. Vaginal examination discloses the vagina of a virgin, very much reddened and inflamed, not encrusted with urinary salts, but containing clear watery fluid. Close observation discloses two papillæ, 1 to 2 millimetres below the posterior border of the external urinary meatus, each being 1 to 2 millimetres on either side of the mid-line, at the place where one would expect to find the openings of the paraurethral ducts. Being watched for a long while, these papillæ were seen to act exactly as does the ureteral meatus in the bladder, namely, to draw back and flatten, remaining dry, and then to push out or raise, the meatus opening up, a single drop of perfectly clear liquid being thrown out. This cycle occurred at long intervals.

Sixteen ounces of a highly colored urine were now withdrawn from the bladder by catheter, and as the fluid exuding from these papillæ was practically as colorless as water, incontinence of urine did not enter into the question, but supernumerary ectopic ureters were suspected. On the basis of this assumption a solution of indigo-carmin was injected into the bladder. This had no effect upon the color of the fluid coming

from these orifices, demonstrating to our satisfaction that there was no communication between them and the bladder.

To detail the entire study made of this case would occupy too much space. Suffice it to say that a careful study of the case, including a number of cystoscopies and a number of urograms, was made, gradually leading up to the following findings:

(1) The ectopic openings of ureters were traced to blind ends lying above the true kidney pelves on each side. These supernumerary ureters were markedly dilated and both of them were so badly strictured in their vaginal portions that instruments could

not be introduced, although fluids could be. It was with great difficulty that the small openings of the supernumerary ureters were dilated to such size that catheters could be passed into them for the purpose of filling these ureters with fluid impervious to the X-ray.

(2) The bladder appeared normal, except for the fact that the ureter mouths were a little close to each other and to the urethral opening. In other words, the trigone was a little smaller than the normal.

(3) Indigo-carmin solution injected into the bladder did not appear at these openings, and reversing the process, indigo-carmin injected into these openings did not appear in the bladder.

(4) We were unable to insert catheters sufficiently far into these ectopic ureters to collect specimens and therefore cannot say whether infection existed there or not. The presumption is that it did, because of the pain in the right upper abdomen, as well as the inflam-



FIG. 1.—Both rudimentary pelves and the dilated tubes leading therefrom are well shown, filled with sodium iodide solution. Both developed kidney pelves and their ureters, all filled with the same solution are also shown on this same plate. The right ectopic ureter shows the strictured areas near its exit.

matory condition of the vaginal mucous membrane. Not being able to collect any fluid we are unable to state that it contained the constituents of normal urine. However, from its constant lack of color we do not believe that it was urine.

(5) Solutions of deep indigo-carmin injected into these tubes showed that their course was along and within the bladder wall on each side. The indigo-carmin solution could be distinctly seen in the bladder wall by means of the brilliantly lighted cystoscope.

(6) On three occasions, the function of the kidneys was tested by indigo-carmin and found to be normal. On none of these occasions did any trace of indigo-carmin come through the ectopic openings. When polyuria was produced, the speed with which these ectopic openings produced fluid was not increased, even though the polyuria was produced to such extent that 300 c.cm. of fluid collected in the bladder from the kidneys within thirty minutes. This occurred upon repeated trials. As nearly as could be

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estimated, not more than 1.5 c.cm. of fluid was voided from each of these ectopic openings during the same period.

(7) As shown in Figure 1, which is a pyelo-ureterogram of the supernumerary and the normal ureters and their terminations, the case corresponds to the reports of most other cases of *supernumerary ectopic ureters*, in that (a) the so-called pelves connected with the ectopic supernumerary ureters are rudimentary in character; (b) that they lie above the true kidney pelves; (c) that the course of these supernumerary ectopic ureters conforms in that these ureters cross the normal ureters twice; (d) that they are dilated and (e) that they are strictured near their external openings. (Fig. 1 shows stricture on right side and Fig. 2 shows stricture on left side.)

DISCUSSION

Kilbane,¹ in reviewing the literature of ninety-eight cases of "Ectopic Ureteral Openings" together with two original cases, gives an excellent bibliography. He classifies these cases as to whether the ectopic openings belong to supernumerary ureters or not, as to whether there are one, two, three or four ureters present in each case, and as to where these ectopic openings occur, namely, whether in the vestibule of the vagina, in the lateral vaginal walls, in the seminal vesicles, et cetera.

He includes in his analysis of these one hundred cases, two cases of complete bilateral duplication of pelves and ureters with bilateral ectopic openings, one reported by Stammer² and the other by Kümmel and Graff.³ On closer analysis it appears that these are two different reports of the same case. Therefore, to our knowledge there is but one other case besides ours reported of so-called complete bilateral duplication of pelves and ureters with bilateral ectopic openings, together with two normal ureters opening normally into the bladder.* Before considering this case further and the operative procedures



FIG. 2.—The left supernumerary ectopic ureter is here shown for the purpose of calling attention to the strictured areas which prevent the passage of a catheter. These strictures are five centimetres from the lower end.

* Since this paper has been written an article has appeared in *Zeitschrift Fur Urologie* (22-Band, 1928, Heft 6) by Dr. Bruno Thom, entitled "Harnleiter—und Nierenverdoppelung mit besonderer Berücksichtigung der extravasikalen Harnleitermündungen", and reporting quite a few new cases.

indicated, we believe that a discussion of this developmental error is in order, because it will lead to a better classification of these cases and be conducive toward better and more standardized surgical procedure.

Anomalies of the genito-urinary system are by no means rare, but have been repeatedly described in the literature during the past fifty years. In 1904 Pohlman⁴ described anomalies of the urinary system in two human embryos (13 mm. and 24 mm. in length) which appear to have influenced the interpretations on most cases observed in the adult since that time. The conditions observed in the embryos described by Pohlman, obviously, point to a splitting of the original metanephric or kidney bud as one method in the formation of supernumerary ureters and kidneys. That supernumerary ureters and kidneys may be formed by another method has recently been established by Chwalla⁵ (1927) who found two separate anlagen or buds on the mesonephric or Wolffian ducts.

The case that is reported in this paper contains certain features which call for a different interpretation than has been applied to similar cases. It also appears probable that the cases described in the last twenty years represent at least two distinct types of anomalies: (1) supernumerary kidneys and ureters due to splitting of the original kidney bud or due to more than one kidney bud on the Wolffian duct, (2) the retention of mesonephric tubules and the Wolffian duct, in which case the "supernumerary ureters and kidneys" are not true kidneys and ureters. The older interpretation of supernumerary ureters and kidneys was that they represent the persistent remains of the Wolffian duct and some of the Wolffian or mesonephric tubules. This thought is well expressed by Furniss⁶ who says, "Probably further study will show that with accessory extravesical openings the upper pole will be found quite rudimentary. This rudimentary development, however, does not always hold true in the cases of double ureters where the opening is intravesical." To better appreciate the developmental possibilities of the genito-urinary tract, a brief review of the early embryology may be of value.

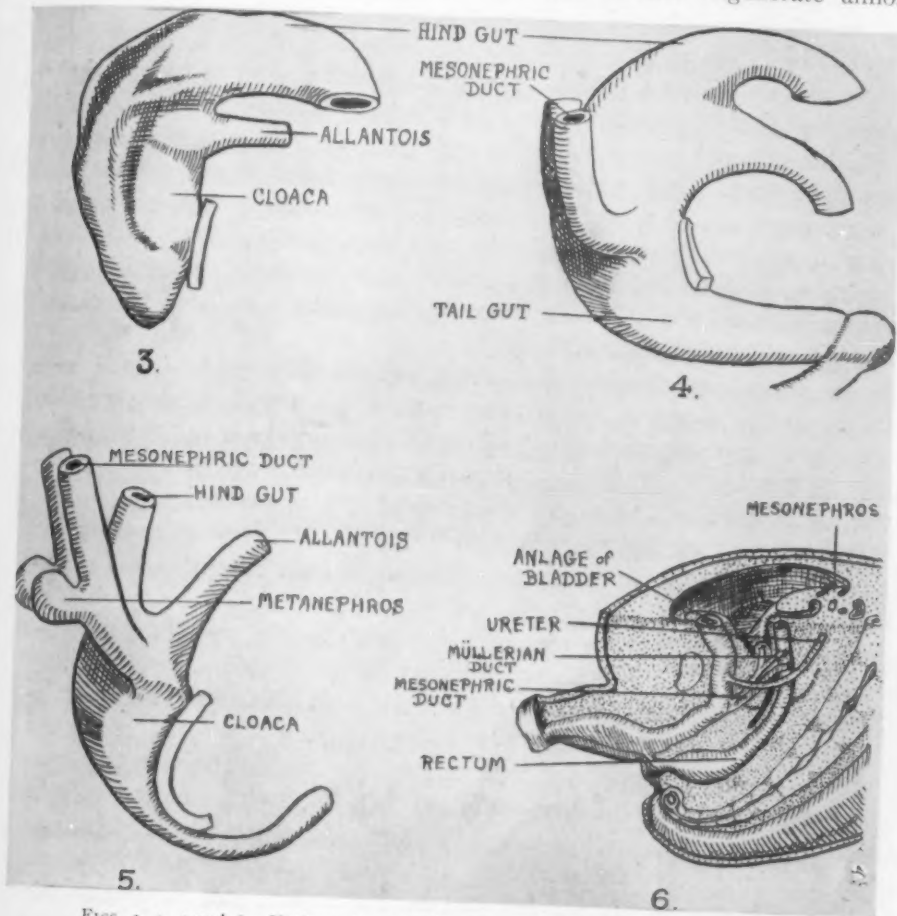
The first indication of an excretory system in human development appears in embryos of about 1.7 mm. in length. This consists of a series of tubules known as the pronephros. The tubules are segmental in arrangement; in morphology they remind one somewhat of the excretory tubules present in the earthworm. The tubules join to form a longitudinal duct—the pronephric duct. The tubules as such degenerate early in embryonic life, but the pronephric duct persists and later is known as the mesonephric or Wolffian duct. Cysts that have been found in the adult mediastinum of the thorax are thought to be the persistent remains of the pronephric tubules.

Soon after the degeneration of the pronephric tubules, a second set of glomeruli and tubules develop and unite with the mesonephric duct. These are the mesonephric or Wolffian tubules. The mesonephric ducts grow caudad and gain entrance into the cloaca—the common chamber of the gut tube and the genito-urinary tube (Figs. 3 and 4). The cloaca later divides

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by a longitudinal fusion-division into two separate tubes, a dorsal rectum and a ventral bladder and urogenital sinus (Figs. 5 and 6).

The mesonephros in both sexes undergoes an early degeneration which is only partial in character, involving some of the anterior and posterior groups of tubules. Later, a second degeneration takes place which varies in the two sexes. The mesonephric or Wolffian tubules degenerate almost



FIGS. 3, 4, 5 and 6.—Various stages in the development of the urogenital system.
(After Prenters and Arey.)

completely in the female. Some of the upper tubules persist as the epoöphoron and a few of the lower tubules become the paroöphoron located in the broad ligament. Most of the mesonephric duct in the female degenerates; the lower end persists as Gärtner's canal which may vary considerably in extent and point of exit. In the male the upper mesonephric tubules are transformed into the ductuli efferentes of the epididymis; the mesonephric duct becomes the ductus deferens and the ejaculatory duct.

The metanephros or permanent kidney originates from two distinct sources. The medulla, pelvis and ureter develop from the kidney bud or

metanephros, an outgrowth from the mesonephric duct (Fig. 5). The kidney bud grows dorsally into the embryonic mesodermal tissue. At the point of contact the mesodermal tissue condenses to form a blastema from which the cortical portion of the kidney is elaborated. While the kidney begins its development in the caudal part of the abdominal cavity, the subsequent growth of the lower abdominal or pelvic region of the fetus together with a very slight cephalad migration of the kidney results in a more cephalad location of the kidney in the adult.

By a process of fusion-division the ureter which was an outgrowth from the mesonephric duct gains an independent opening into the bladder (Fig. 6).

The bladder and urogenital sinus undergo considerable modification in later development. The ventral urogenital sinus grows to the surface and opens to the outside, forming the urethra. The mesonephric ducts are carried forward in the growth process. In the male they empty into the urethra as the ejaculatory ducts, while in the female they lose their connection with the urogenital tube and gain independent openings in the walls of the vagina and persist as Gartner's ducts.

From the röntgenological and direct examinations made in the case described in this paper, it appears that the anomalies present represent the persistence of the mesonephric or Wolffian ducts and parts of the original mesonephric tubules. That these structures, as such, may persist into the adult does not appear to have been considered in the recent literature.

In many cases of supernumerary kidneys, the accessory kidneys appear to have distinct pelves, and it appears obvious in such cases that the supernumerary kidney originated from a splitting of the original kidney bud or from double anlagen on the mesonephric duct. In the case here reported there are no pelves indicated in connection with the ectopic ureters, but they appear to end rather blindly at the upper poles of the kidneys. Such a relationship indicates that there is no true kidney structure present. It appears likely that the tissue connected with the ectopic ureters represents a persistence of mesonephric tubules. Obviously, to determine this it would be necessary to make a careful histologic examination of the tissue. This was not possible in the case under consideration, as the patient would not submit to a heminephrectomy. In the few pathological reports that have been published on the nature of the tissue draining into the ectopic ureter, there has been reported hydronephrotic kidney tissue. In a number of cases reported in the literature the kidney containing the accessory ureter was greatly elongated, and the part drained by the ectopic ureter was distinctly marked off on the surface by a shallow depression from the remaining part of the kidney. If the tissue in question were in reality mesonephric tissue, this would not be greatly different in appearance to hydronephrotic kidney tissue. The mesonephric tubules and glomeruli are considerably larger than the same structures in normal kidneys, and it does not seem unlikely that a cursory examination of mesonephric tissue may be mistaken for hydronephrotic tissue. As regards the persistence of the mesonephric or Wolffian duct, the evidence in the case

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under consideration points to this probability. While the major portion of the ducts normally degenerate in the female, Gärtner's ducts, which sometimes persist into the adult, are persistent remains of the lower ends of these embryonic tubes. The ectopic ureters in this case open in the position of Gärtner's ducts. Further, in a true ureter one would expect to find a relatively thick wall containing muscle and connective tissue fibres, while the mesonephric duct is only an epithelial (mesothelium) tube. The experience in attempting to ligate the ectopic ureters indicated definitely a simple epithelial tube.

It is a simple matter to explain the persistence of the mesonephric duct in the female where it normally degenerates, but in the male where the duct normally persists as the ductus deferens the interpretation becomes more complicated. In the male it would appear that a splitting of the mesonephric duct would be necessary to account for a normal ductus deferens and a persisting mesonephric duct which drains a persistent group of mesonephric tubules. According to Felix and Bühler⁷ (1906) two primitive canals may develop in the mesonephros of some of the fishes—a true mesonephric or primary ureter and a second tube which they name "kidney-wall-canal" (Nierenrandkanal). In some groups of fishes the "kidney-wall-canal" becomes the functional ductus deferens, while in other groups (Ganoids and Selachians) the primitive ureter functions as the ductus deferens. In the amphibia and the amniotes the "kidney-wall canal" develops, but soon degenerates so that the mesonephric duct takes on the functions of the ductus deferens. While these conditions are present in animal groups that are far removed from man in phylogenetic scale, this does not exclude the possibility that a similar process may recur in human development.

In normal development of the male after the first degeneration of the mesonephric tubules is completed, the upper group of remaining tubules is retained as the ductuli efferentes. The lower group of remaining tubules usually degenerates. It appears likely that a group of tubules from the lower portion of the mesonephric body may sometimes persist into adult life. These tubules would retain their connection with the mesonephric duct. If this occurred in the male, it would be necessary for the mesonephric duct to split into two tubes from the point where the persistent tubules joined the duct. It is also possible that abnormalities of the sexual organs accompany supernumerary ectopic ureters in the male. From some of the descriptions in the literature, one is lead to surmise that a normal vas deferens and seminal vesicle are missing on the side of the supernumerary ectopic ureter in the male. In the female it would merely call for the persistence of the mesonephric duct.

Another problem presents itself which may ultimately reach solution when a careful histological study can be made of the tissue that is drained by ectopic ureters of the type under consideration. The question has long been under discussion whether the mesonephric tubules in the human fetus actually secrete. Many investigators have held that there is no secretion. Recently, however, Kornfeld⁸ (1926) by means of staining reactions claims

that he can demonstrate a secretion in the tubules. Ernst⁹ (1926), on the other hand, believes that the masses found within the tubules represent degeneration masses and that the mesonephros does not secrete. In the case reported in this paper, there is a secretion coming from the tissue drained by the ectopic ureters. From the superficial examination made of this secretion it does not appear to be urine. Obviously, it is necessary to carefully examine the tissue histologically before one can definitely state that it represents embryonic tissue.

Treatment.—Various methods have been suggested in the treatment of incontinence in the female, due to ectopic ureteral openings. The following methods have been used:

(1) The tying-off of the ectopic tubes in the vagina—a minor operation—with the hope of producing atrophy of the corresponding kidney.

(2) "Pyelo-pyelostomy" as performed by Kümmel.³ This consists of an attempt to connect the upper end of the supernumerary tube to the kidney pelvis on the same side.

(3) The introduction of the aberrant tube into the bladder.

(4) The draining of the ectopic ureter into the bowel.

(5) "Heminephrectomy" or the removal of the part drained by the supernumerary ureter, namely, the upper pole.

It is evident that ectopic ureters are of two kinds: (1) Those that are supernumerary and (2) those that are not. This study is concerned only with the supernumerary type.

In the treatment of this patient, unfortunately, we could not obtain permission to do that which we considered best, namely, the removal of the upper portions of the kidneys. It was the plan to remove these upper poles on two different occasions, giving the patient ample time to recover from the first operation before the second was attempted. The second operation was to be made only in the event the first operation was a success. However, she would submit to no major operation, maintaining that the condition did not bother her sufficiently to warrant such procedure.

When the various methods of attacking the problem were presented to her, she consented to the tying-off of each tube underneath the vaginal mucous membrane, and this was attempted. A catheter was placed in each of these ectopic openings. It was easy enough to dissect back of the catheters and to pass a ligature around each of these ectopic tubes. However, it was recognized at the time that this was done that there was no ureteral wall in this case. There appeared to be only an epithelial tube with no muscular support and no fibrous covering. It was feared that the silk ligature would cut through. This is exactly what occurred and is here recorded so that this operation should be undertaken in the future with this probable failure in mind.

From a consideration of our case and a study of the literature on ectopic ureters, we propose that these anomalies be distinguished by two types, as follows:

(A) Those cases in which the so-called supernumerary ectopic ureter is

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not properly speaking a ureter, but a persistent mesonephric duct, and the body which it drains is a persistent mesonephric remnant. Obviously, if this body which is drained by the supernumerary ectopic ureter is a mesonephric remnant, its removal would not interfere with total kidney function. While we have no way of knowing before operation the type of blood supply to the normal kidney and the accessory structure in any individual case, it has been found, almost universally, both in operated and autopsy cases, that the accessory body has its own blood supply. Its removal is therefore practical. "Pyelo-pyelostomy" would be more difficult of performance and would have no advantage over a heminephrectomy. Since the evidence of others shows that these so-called supernumerary kidneys are generally infected, it would be an error to lead the tubes from them into the bladder and expose the bladder to infection, thus also endangering the true kidneys. We have found that the ligating of the supernumerary ureters at their lower ends is impractical, despite the apparent success of a few cases reported in the literature. Other operative procedures reported in the literature do not warrant any discussion.

(B) The cases of ectopic ureters, that are not supernumerary, do not appear to drain embryonic rests or remnants, and have not been studied by us. Consequently we have no suggestions to offer regarding their treatment at this time.

CONCLUSIONS

We have presented a case with two normal kidneys, each containing one normal kidney pelvis and each pelvis leading to the bladder by a ureter normally placed. The possessor of this normal urinary system has two accessory bodies, one resting above each kidney, and these bodies secrete a fluid in no way resembling urine. This fluid is conducted outside the body by tubes which open at the position of the paraurethral ducts, one on each side of the mid-line. Further, these tubes follow the course in the walls of the bladder and vagina that is usually taken by Gærtner's canal, which has long been known to be the persistent remains of the mesonephric or Wolffian duct.

(2) We have attempted to classify the so-called ectopic ureters so that the supernumerary ectopic ureters may be considered from a different point of view than the ectopic ureters which are not supernumerary.

(3) For the cases of supernumerary ectopic ureters, we wish to endorse the view of Furniss, Herbst and Polky,¹⁰ and Kilbane, approving "heminephrectomy".

(4) We wish to emphasize that cases similar to the one we have described are strongly suggestive of persistent embryonic structures.

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THE ETIOLOGICAL RELATIONSHIP OF CHRONIC APPENDICITIS AND THE SMALL CYSTIC OVARY

BASED ON A STUDY OF 256 CASES

By KELLEY HALE, M.D.

OF WILMINGTON, OHIO

SOME years ago I noticed that my cases of chronic appendicitis were often associated with tender and enlarged ovaries of the small cystic or hyperplastic type. It seemed as if the right ovary alone was more often affected than the left alone.

We decided to take careful notes on the ovaries of these cases and it fell to the lot of Kathryn Williams, pathologist to Hale Hospital, to inspect and record the gross appearance of these ovaries at the operating table. Nearly all of the cases reported were observed from the pathologist's viewpoint and likewise the analysis of our findings were made by the same person.

At the onset, let me state that the ovarian condition in this series is reported only in those cases in which chronic appendicitis was demonstrated microscopically and in most cases macroscopically.

I know there are men who teach that there is no such disease as chronic appendicitis. One of my medical associates who recently spent a year in one of our leading universities came home thoroughly convinced that even acute appendicitis did not exist, because he did not see any in the wards and no one said anything about appendicitis except to deny it; but he was strong on the gall-bladder. After I had shown him a half dozen appendiceal abscesses within a short time, his mind reluctantly condescended to drop below the transverse umbilical line again.

When I studied pathology we were given sections of the appendix as a very fine example of chronic inflammatory reaction.

John B. Deaver¹ says, "In discussing chronic appendicitis let me take this opportunity to protest against the practice of teaching by word of mouth or by pen that chronic appendicitis is not a clinical entity, and that too many so-called chronic appendices are being removed. Chronic appendicitis, I say, is a clinical entity and a surgical fact and not a fancy. It may be grouped into two types: the first follows attacks of acute appendicitis, and the other is chronic from the onset."

While it is generally known that acute appendicitis can produce ovaritis by contiguity or by infection being carried through the lymph channels in Clado's ligament as maintained by Deaver and denied by Kelly; but that chronic appendicitis has any action deleterious to the ovary is scarcely mentioned in the English literature. So our study has given us something to think about.

I have been able to demonstrate to my own satisfaction that there is such a structure as Clado's ligament which in some cases is well marked.

As I studied the sections of these chronically inflamed appendices microscopically, I noted in practically all of them definite changes in the serosa. The blood-vessels and capillaries were surrounded by chronic inflammatory cells and grossly, by very definite peritoneal reactions of the cæcum, ascending colon and adjacent parietal serosa.

I have demonstrated many times to my assistants, the effect particularly of the chronically diseased appendix upon the retroperitoneal layer as evidenced by a thickened transparent peritoneum in which are imbedded a great

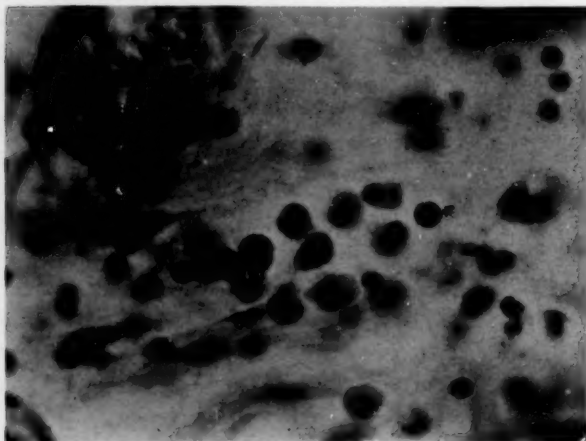


FIG. 1.—A group of plasma cells and some lymphocytes located in the serosa of a chronically inflamed appendix, a very common finding.

number of fine long red capillaries generally running in a more or less parallel direction. This reaction corresponds definitely to the areas swept by the appendix attached to a more or less mobile cæcum. I have often likened this phenomenon to the bare ground produced by a dog chained to his kennel.

The moist condition of the abdominal vis-

cera is due to a very finely adjusted transudation of fluid from the peritoneum. If there is sufficient toxic material in the serosa of the appendix to bring about a perivascular reaction of greater or less degree, then one would naturally assume that the fluid thrown out for lubricating or other purposes might contain a greater or less amount of toxins which if not rapidly detoxicated would likewise cause cell and tissue reactions wherever present. Every abdominal surgeon of experience is familiar with these reactions. Since someone has reported something like 20 per cent. of appendices in operation cases situated in the pelvis, the right ovary especially would be subjected to the action of toxic fluid. It is not uncommon experience at all to encounter in these cases of chronic appendicitis an ounce or more of free fluid in the cul-de-sac of Douglas and bathing the ovaries which are very often prolapsed into this pocket of slow absorptive power.

That the ovaries do react is evidenced by the more or less thick tough, white cortex and everyone seems to be agreed that the thickened cortex is the cause of failure of the graafian follicle to rupture at maturity and a retention cyst results.

Papers on appendicitis are comparatively infrequent now and the ovary in medical literature is treated like the black sheep of a family. The pendulum has swung from fiendish radicalism to extreme and unreasonable con-

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servatism. In fact word has come to me from high authority that an ovary never was tender or painful or produced a single symptom.

I have read all of the books in the Library of the University of Cincinnati College of Medicine on the subject of the follicular cyst, and chronic appendicitis as an etiological factor was not discussed. At the Cincinnati General Hospital Library, I found only a few articles in English that recognized the etiological relationship of chronic appendicitis and the follicular cystic ovary. However, the French and German surgeons seem to have given some thought to the subject.

My purpose in presenting this paper is to call attention to the baneful influence of chronic appendicitis upon the ovary and to urge the early removal of the diseased appendix and thus conserve the ovary and its important internal secretion.

Analysis of Our

Cases.—Of 256 cases of chronic appendicitis analyzed within a given period of time 76 per cent. were associated with the small cystic ovary affecting one or both ovaries and 24 per cent. were unassociated with the cystic ovarian condition.

In my cases of chronic appendicitis associated with the small cystic ovary which have been studied, the age of the patients ranged from eight to fifty-one years with an average age of twenty-two years. Fifty-eight per cent. were married and 42 per cent. unmarried. The duration of the time of symptoms of appendicitis ranged from ten days to thirty years with an average time of four years. In 28 per cent. of these cases the right ovary was affected alone, 6 per cent. the left ovary alone, and in 66 per cent. both ovaries were affected. When both ovaries are affected, the right is larger than the left usually and this fact I think is a striking and significant observation. Sixty-three per cent. gave history of dysmenorrhœa; 26 per cent. no dysmenorrhœa and 11 per cent. indefinite menstrual history.

It is well to note here that the midline incision is the ideal incision for every woman and the one which I routinely employ since it gives full opportunity to take care of any pelvic complication which may be encountered.

From a practical standpoint I have reached the place where I feel that an

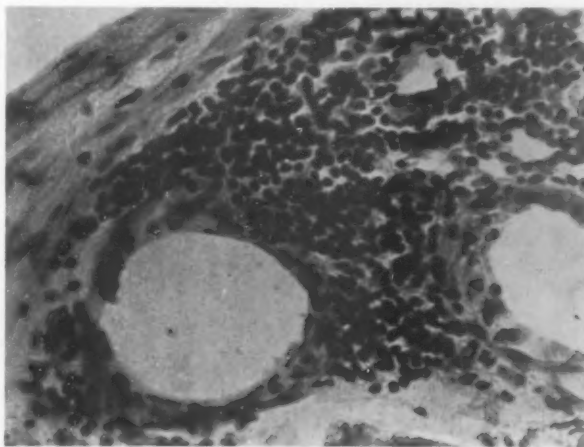


FIG. 2.—A marked perivascular collection of small lymphocytes, a common finding in the serosa of the chronically diseased appendix. The fine long capillaries in the serosa of the cæcum are surrounded by cuffs of these cells at varying intervals as shown by whole mounts.

enlarged and tender right ovary, non-specific, means chronic appendicitis even though the appendix is not tender, an operation is clearly indicated.

I wish to quote from a few authors to substantiate my thesis. Clarence Reginald Hyde² quotes Schmitt as believing that a chronic appendicitis may cause pelveo-peritonitis. C. B. Lockwood³ says, "I do not know why an ordinary cyst of the right ovary should be so often associated with appendicitis unless it be that Clado's ligament forms a more potent continuity of tissue than some think. Inflammation of the appendix may be associated with tumors of the uterus."

L. N. Lapeyre⁴ reports seventeen cases from which he concludes that chronic appendicitis in women seems to be habitually accompanied by degeneration of the ovaries. The ovarian lesions may cause spontaneous and induced pain during and between the menses, dysmenorrhœa, irregular menstruation and hæmorrhage. The uterus at the same time generally shows signs of hyperplasia and is often displaced. The whole trouble is probably some primary disturbance in the sympathetic nervous system; this explains the alterations in the various organs as the nutrition suffers—ptosis, colitis, and sclerocystic degeneration of the ovaries and chronic inflammation of the appendix. The central nervous system irritated by some peripheral disturbance in some lesion of the vulva, vagina, uterus, appendix or pelvis reacts by a reflex mechanism of the trophic nerves of the ovary. Treatment should aim to cure local lesions before the central nervous system has been too seriously impaired. When the abdomen is opened it should be on the median line in women so as to permit systematic inspection of the entire pelvis and appendix region.

Drs. W. H. Luckett and Frank Grauen⁵ state that follicular cysts occur more frequently in the right ovary on account of the appendiculo-ovarian ligament; a fold of peritoneum which runs between the base of the appendix and the hilum of the ovary in which there are a great many lymph channels and on account of absorption of toxins from chronic appendicitis.

Often chronic appendicitis causes gastric disturbance, pylorospasm, intestinal indigestion as well as constipation due no doubt in part at least to irritation of the sympathetic nervous system. Certainly such a general abdominal disturbance as this would also cause reactions of some sort (trophic) in such complex and sensitive organs as the ovaries.

The majority of writers are agreed that follicular cysts are due to ovaritis, although a few men and among them some of the best, contend that these cysts are normal. If ovaritis is the main cause, then the great frequency of cystic ovaries in girls and women free from any possible specific infection, must derive their cysts from infection to be found in a diseased appendix alone. This particular group of patients give us our clearest view into the causal relationship of appendicitis to follicular cysts.

I do not wish to go on record as saying that appendicitis causes all follicular cysts; but rather that the diseased appendix has a far more baneful effect upon ovaries than is commonly recognized.

From a study of our ovarian material, gross and microscopic, I am of the opinion that the conditions we see are not all reactions of ovaritis, but rather toxico-trophic changes analogous to the fibrous changes we see in the muscles of laborers and athletes. In other words, we have a toxic hyperæmia (a source of more food) with an actual increase in the stroma tissues, particularly on the cortical surface and by its toughness preventing the rupture of normal graafian follicles. In many instances this stroma reaction is so

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general that few graafian follicles are able to develop and consequently few if any follicular cysts, even in ovaries twice the normal size, are seen.

In acute ovaritis polynuclear leucocytes are abundant and the ovary reacts with chronic inflammatory cells but not of the marked degree that we see in the appendix. There are different degrees of fibrosis taking place in these ovaries.

The first problem before us was to determine whether or not these cysts were normal graafian follicles in different stages of development as some surgeons maintain. As

I have been generally interested in the cytology of the mysterious germ cells for many years, I had a further inducement to make serial celloidin sections of our human ovarian material, searching carefully the unstained sections for the ovum surrounded by its discus proligerus. While I was very anxious to collect all of these ovules I could find,

nevertheless, the fact remains, after much hard work that we found very few normal graafian follicles with ovules to add to our collection. Although many surgeons claim they can tell a graafian follicle grossly from a follicular cyst, I must confess in the light of our research that I have been unable to do so and furthermore any surgeon who wishes to puncture follicular cysts can carry out his technic with little fear of destroying an ovum.

Pathologists have been unable to add anything to Virchow's classic description of follicular cysts made in 1865 and which is as follows: "The characteristic feature of the true follicle hydrops is that in the beginning of its formation, at least an ovum is found in the fluid, because the formation occurs thus; that a larger quantity of albuminous watery but not mucoid fluid accumulates in a graafian follicle that usually contains a cell mass, an ovum, and a membrana granulosa. Later on the ovum dies. One can clearly see how it disintegrates. First its protoplasmic mass becomes a softer substance which is easily divided and is finally completely dissolved. Then there is merely a serous sac left. Occasionally this cystoid degeneration occurs in a solitary follicle; and in the main it can be accepted that unilocular hydrops of the ovary is of follicular origin. But I have shown that not a few ovarian dropsies which are multilocular in the beginning secondarily coalesce and form a single sac."

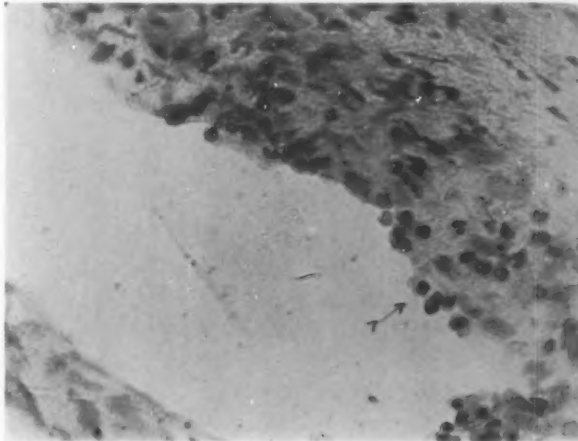


FIG. 3.—This shows a detachment of leucocytes invading the serosa of an appendix, representing a stage of acute exacerbation.

It is only those cases of follicular cysts of the ovaries that are not due to the following possible causes exclusive of appendicitis that I wish to stress; the presence of a diseased appendix is the only apparent if not real cause. The general causes to be enumerated are pyosalpinx, chronic adnexal lesions, peritonitis, myoma, retroversion and other misplacements, metritis and perimetritis, venous hyperæmia from prolapsed ovary, too slight congestion and interstitial oophoritis.

Graves is of the opinion that in certain instances it is likely that dis-

turbances of circulation, such as repeated or continuous hyperæmia may cause a too rapid development of the primordial follicles and hence an overproduction of atretic follicles.

While it is generally conceded that the corpus luteum regulates through its internal secretion the mechanism of menstruation, I have often wondered

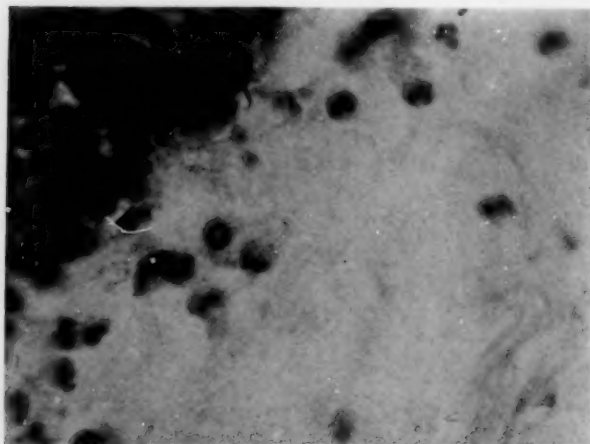


FIG. 4.—Loose battle formation. Leucocytes advancing into the serosa, certainly to attack an ambushed enemy.

what selected a certain ovum in most cases to develop and ripen in preference to hundreds of others; although more than one ovum are at times discharged together.

A study of the egg formation in insects and nematodes has shown me that their eggs are formed in long tubes in which we can see all stages of development down to the finished and ornamented product, and representing an exquisite series of metabolic gradients both individually and collectively.

Although in the human ovary we cannot see any definite linear arrangement of ova like in the cabbage butterfly, for instance, save as suggested by the egg tubes, nevertheless there must be some physiological gradient here analogous to lower life that is not morphologically apparent because as Graves points out, there are only about 14 to 18 follicles that reach maturity each year. In the ovaries of young rabbits there are so-called egg tubes of Phluger growing in from the germinal epithelium, a condition such as suggested above.

Undoubtedly in ovaries with a thickened cortex there is an upset of the normal physiological cycle. The accumulation of fluid in atretic follicles seems to contribute to further degeneration of normal follicles. G. L. Rhodenburg and A. M. Hellman⁷ have shown that injection of saline extract of corpus luteum into guinea pigs causes marked cystic degeneration with loss of normal recessive phenomena.

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Since many cases of chronic appendicitis follow acute attacks, we have here a source of ovaritis infective in character and a cause of cystic ovaries. Appendiceal adhesions, more or less marked, are common and indicate that the local infection has extended beyond the appendix. Patients operated upon in this stage of acute inflammation will often have their wounds infected from germs free in the peritoneal fluid. Those cases of appendicitis which are chronic from the onset probably affect the ovaries through toxins liberated through the serosa. No doubt toxins carried by the lymph and blood streams from the appendix also affect the ovaries.

If it were true that small cystic ovaries are never painful or tender and never give rise to symptoms, nervous or otherwise, there would be no need for this paper. However, after carefully studying our cases, I am thoroughly convinced by the evidence that chronic appendicitis in women on the whole, presents a more complex symptomatology than in men.

Where the ovaries are affected, often they present more marked reflex and gastric symptoms than do those patients with no cysts of the ovaries. Dysmenorrhœa is not uncommon and with only one ovary cystic, the former is apt to occur on alternate months. I have in mind a patient, daughter of a physician and a teacher in one of our large city High Schools who, before she came under my care had suffered for years from dysmenorrhœa and had her uterus dilated twice by a very competent gynæcologist of Cincinnati. No relief was experienced and the pains were so severe that morphine had to be resorted to each month. Examination revealed that she was suffering from chronic appendicitis and both ovaries were enlarged and tender to touch. Removal of the appendix and plastic operations on the ovaries completely cured her and she has no desire for morphine.

A very reputable surgeon of Chicago told me that the pain or tenderness that we think is in the ovaries comes from the appendix; and that when the appendix is removed the pain stops. To refute this idea which is seldom true and at the same time to show how difficult it is always to do the right thing in these cysts of the ovaries, I cite the case of a girl eighteen years of age suffering from chronic appendicitis and small cystic ovaries. The appendix was removed and the cysts punctured. She was soon much improved, gained weight and after some months she began to have severe pains at her periods with great tenderness and some enlargement of her left ovary. Being put to bed, we were forced to reoperate upon her, removing the left ovary, the cysts having refilled; it was removed because the entire organ was a mass of small cysts. She was cured following this operation.

It has always been and is still a question with me what to do when we encounter these small cystic and hypertrophic ovaries in the course of an appendectomy. It would seem as you will see later that the majority of surgeons and gynæcologists recommended no interference, that is, no puncture, plastic or removal of the diseased ovaries.

Three things I have long since learned in practice, first, to have an open mind and to accept no man's diagnosis or opinion on faith. One must

observe and think for himself, consequently I have practiced the usual classical surgical procedures upon this type of ovaries and observed results.

I feel that the removal of the appendix as a source of toxic and infective irritation of the ovary is all that is required in many cases, however those with tender ovaries, dysmenorrhœa, nervous and exaggerated gastric and reflex symptoms require some type of surgery either puncture if only one or a few cysts are present; plastic for very large prolapsed organs; and where there are a great number of cysts both on the surface and within the ovary

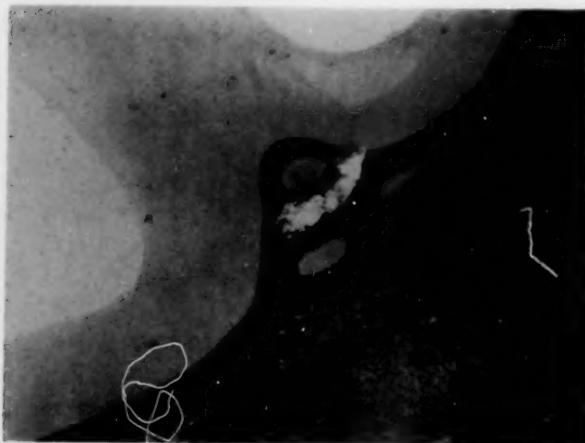


FIG. 5.—An ovum ready to escape but unable to do so because of a thick tough ovarian cortex.

either subresection or removal is indicated. I try to be as conservative as possible. I do not think that anyone has a right to be dogmatic in his method of treatment, for I have had the family physician tell me later that I should have removed Mrs. E.'s right ovary or that Mrs. F. was no better after resection of both ovaries, etc. It may be when I get my

mind perfectly adjusted to all these different results, that it will be time for the conservatism of age to set in and dominate my practice.

One point I wish to make is that sensory nerves which have withstood constant irritation for long periods of time require considerable time to recover their normal function, if they ever do. Therefore early interference in cases of chronic appendicitis should be instituted in order to stop this nerve irritation. I have examined many patients following appendicitis and find that they retain their tender points for years even though they are well.

Just as we can have what Deaver calls the cirrhosis of delayed operation, we can also have marks of delayed operation upon the sympathetic nerves and plexus to the appendix and ovaries.

We must have early operations for appendicitis in women if we expect to avoid ovarian complications and the bad results of ovarian surgery in late cases. I think that most surgeons and gynecologists agree that the unilocular cysts that may reach the size of a hen's egg with the remaining portion of the ovary practically normal, require resection. Very often they occur on the dependent end of the ovary.

Findley* has well stated the indication for surgery as follows: "Cystic degeneration of the ovaries doubtless contributes to a general nervous state, but in my judgment this can only be due to the local discomfort. I doubt if

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there can exist a general disturbance of the nervous system referable to the ovaries without local disturbance. Therefore in the absence of local disorders, the general nervous phenomena should not call for surgical intervention or for interference with the ovaries."

A summary of the answers to a questionnaire sent to surgeons and gynaecologists in our great medical centres, all members of the College of Surgeons, pertaining to different phases of the small cystic ovary is appended. A glance at it will convince anyone that the "perfect day" of our knowledge on this subject is far off.

The questions and analysis of the answers are as follows:

1. What do you think is the cause or causes of follicular cysts of the ovaries?

2. What do you think is the cause of follicular cysts of the ovary when not associated with tubo-uterine disease or pelvic inflammation?

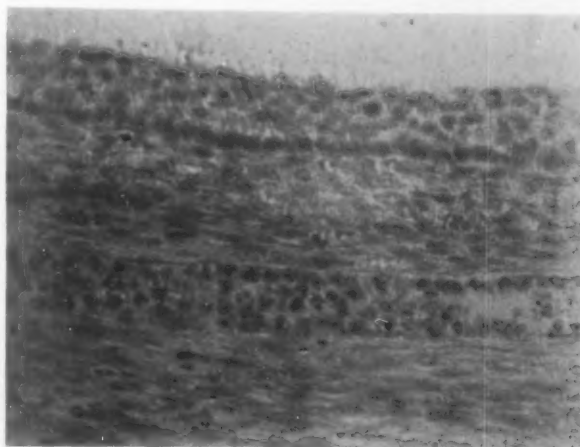


FIG. 6.—A photomicrograph of Fig. 5, showing the wall of the Graafian follicle paralleled by a blood-vessel crowded with leucocytes.

Answer. There seems to be a diversity of opinion among surgeons and gynaecologists as to the causes of the above since there were 64 different opinions offered on the first and 65 on the second, showing a wide range of fact and imagination.

3. Are follicular cysts normal? Yes, 28 per cent. Yes, with reservations 12 per cent. No, 51 per cent. Doubtful, 9 per cent.

4. Do follicular cysts cause referred symptoms? Yes, 43 per cent. No, 26 per cent. Sometimes, 16 per cent. Doubtful, 15 per cent.

A few symptoms suggested are pain qualified as intense or pain in ovary; hot spot; burning sensation; produced under such conditions as prolapse of the ovary, enlarged ovary, pressure on nerves, dysmenorrhœa, pain at time of ovulation, soreness coincident with the menstrual period and chronic appendicitis.

5. Do follicular cysts ever produce painful or tender ovaries? Yes, 62 per cent. No, 15 per cent. Sometimes, 16 per cent. Doubtful, 9 per cent.

Conditions suggested which produce the above are large and tender ovary, pressure, prolapsed ovary, hæmorrhagic condition, tension and ovaritis.

6. Do follicular cysts ever cause dysmenorrhœa? Yes, 46 per cent. No, 32 per cent. Doubtful, 16 per cent. Probable, 6 per cent.

7. Do follicular cysts cause other menstrual disturbance? Yes, 42 per cent. No, 29 per cent. Sometimes, 11 per cent. Doubtful, 18 per cent.

8. In your opinion, do follicular cysts occur more frequently in one ovary than the other, if so, which one? What is your explanation? Right ovary alone 40 per cent. Left ovary alone, 32 per cent. Both ovaries, 28 per cent. The following explanations are offered for this condition:

Left ovary, due to poor circulation, trauma of the sigmoid, circulation disturbed by constipation, direct line for infection, blood stasis on account of anatomical arrangement of ovarian vein.

Right ovary, due to cæcum and appendix, most incisions permit best view of right ovary and it is more often examined, inflammatory condition on the right side of the abdomen, result of appendiceal irritation with increased vascularity in this region and proximity to the appendix.

Both ovaries, due to blood stasis.

Causes of the hypertrophic ovary are set forth as inflammation, hyperæmia, circulatory irregularities, rupture of follicle not taking place, congenital or endocrine, active sex life, associated with uterine fibroids, thyroid endocrine disturbance.

10. What causes the ovarian cortex to become thickened and tough, either with or without cysts, in the absence of any pelvic inflammation or uterine displacement?

A great number either did not answer or said that they did not know; but at least a variety of opinions were offered as there were forty-five different causes set forth causing a thickened cortex.

11. Do you think that toxins which find their way into a normal amount of peritoneal fluid from abdominal disease such as inflammatory affection of the gall-bladder, stomach, colon, etc., could have any effect upon the ovaries? Yes, 18 per cent. No, 64 per cent. Doubtful, 9 per cent. Possible, 9 per cent.

12. Do you treat small cystic ovaries surgically? Yes, 39 per cent. No, 46 per cent. Sometimes, 15 per cent.

13. What is your treatment? Many state that treatment depends upon the size of the cyst and state of the patient. Otherwise the treatment suggested covers a wide range of medical and surgical procedure.

14. Can you distinguish between a follicular cyst and a graafian follicle by inspection alone? Yes, 39 per cent. No, 45 per cent. Doubtful, 16 per cent.

15. Do ovaries possess sensory nerves? Yes, 75 per cent. No, 18 per cent. Probable, 7 per cent.

The following is quoted from remarks which were made pertinent to this subject:

"Operate upon a young woman for mild type of chronic appendicitis, remove the appendix, inspect ovary; if cystic and small, stab and express. Leave this ovary without this procedure and she will continue to have pain and that burning spot."

"A normal ovary is not sensitive."

"Pelvic pathology causes are little known."

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"It may be that escape of follicular fluid is irritative in some individuals and hyperplastic connective tissue forms in the ovarian cortex as it does elsewhere in the body in response to persistent irritation."

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ADENOCARCINOMA OF THE TESTIS IN THE ADULT

BY A. RAYMOND STEVENS, M.D.

AND

JAMES EWING, M.D.,

OF NEW YORK, N. Y.

THE origin of the common cellular malignant tumors of the testis has never been fully determined. For many years two somewhat divergent views have been maintained. Wilms and Pick, making many sections in all portions of malignant tumors and finding in most of them evidences of mixed or teratomatous structure, concluded that nearly all the cellular tumors are of embryonal and teratomatous origin. A specific exception is the rare adenoma of the testicular tubules, described by Chevassu and Pick, which they derived from the adult spermatic tubules. Pick's dictum of the one-sided development of teratomas, one anaplastic element outstripping and suppressing all the others, has found a rather wide application, and has done much to support the teratomatous origin of testicular tumors, especially of the benign growths. In 1911, one of the present writers, after a study of a series of testicular tumors, was able to bring some additional evidence supporting the views of Wilms and Pick. In that study teratomatous elements were found in portions of some very early round-cell tumors. A peculiar lymphoid stroma was found to be characteristic of many embryonal tumors. Teratomatous features were found not only in the typical embryonal carcinoma with lymphoid stroma, but also in more adult tumors with fibrous stroma, the alveolar sarcoma of older writers. This latter tumor seems to be identical with the so-called seminoma of Chevassu, which that author believes to be derived from adult spermatoblasts. For these reasons, it seemed necessary at that time to admit that nearly all the malignant tumors of the testis are of embryonal teratomatous origin. The application of the theory of Wilms and Pick was thus somewhat extended. Since no one observer could assume that he had seen all the possible tumors of the testis, it was not claimed that rare malignant tumors of other types might not occur, but it was demanded that somewhat specific differences in the structure and clinical course of such rare tumors should be forthcoming before their exceptional character could be maintained.

The second view has been adopted by many French writers, especially by Chevassu. While recognizing the occurrence of many embryonal tumors with teratomatous elements, Chevassu maintains that the common round-cell tumor of the testis is derived from adult spermatoblasts and is neither embryonal nor teratomatous. He finds it possible to identify tumors arising, some from the inner and some from the outer, layers of cells lining the adult spermatic tubule. He was not able to trace the origin of any of these tumors to the spermatic tubules but bases the diagnosis on the resemblance of the tumor cells to the spermatoblasts. Clinical features separating the embryonal from the adult tumors were not observed.

Careful students of the recent literature will also discern a tendency to

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identify the two theories, by assuming an origin of many tumors from partly embryonal tubule cells distributed throughout the testis in normal tubules.

A third hypothesis has sometimes been discussed, viz.: that the presence of a teratomatous tumor might excite a malignant tumor process in the adult tubule cells.

Among recent writers the two main contending theories have enjoyed about equal popularity, but it does not appear that any new facts have been brought out which could decide the question at issue. Recently, however, Gordon Bell has contributed an important study which favors the origin of certain tumors from the testicular tubules. He points out that these tumors generally occur in middle life, grow more slowly than the embryonal tumors, and that transitional stages of transformation of normal into tumor tissue can apparently be traced. We have never been able to trace such transformations in any of the malignant tumors, but have long been awaiting the observation of a case in which it seemed



FIG. 1.—Gross appearance of multicystic tumor involving much of the body of testis.

possible, and in which other structural and clinical features suggested an origin of the tumor from adult cells. The present case seems to have furnished the long desired opportunity.

It might be supposed that a decision regarding the exact origin of testicular tumors is only of academic interest. Yet, this view is not in accordance with certain facts, because most malignant testicular tumors carry a very bad prognosis, which determines certain lines of treatment based on course and outcome. Moreover, most embryonal tumors are highly radiosensitive, and metastasize very early, while adult tumors may be expected to be less radiosensitive and to disseminate less early, so that surgical removal rather than radiation might be indicated.

CASE HISTORY.—Mr. J. M. W., fifty-one years of age, weight 210 pounds, complained of some gastrointestinal disturbance for some months. In June, 1926, first noted swelling of right testis. Wassermann negative in blood and spinal fluid. In right side of scrotum there was found a mass as large as a goose egg, with slight hydrocele. On removal of

20 cc. fluid the testis felt normal, but there was a small nodule at upper end and a larger smooth rounded mass at lower end, supposed to be in epididymis. On March 3, 1927, exploration under cocaine, showed the small mass to be in the globus major, while the larger mass was subsequently proven to be in the body of testis. On separating the epididymis, a large amount of clear fluid escaped from testis, and on pressure much more fluid escaped, reducing the size of the organ to nearly normal dimensions. The

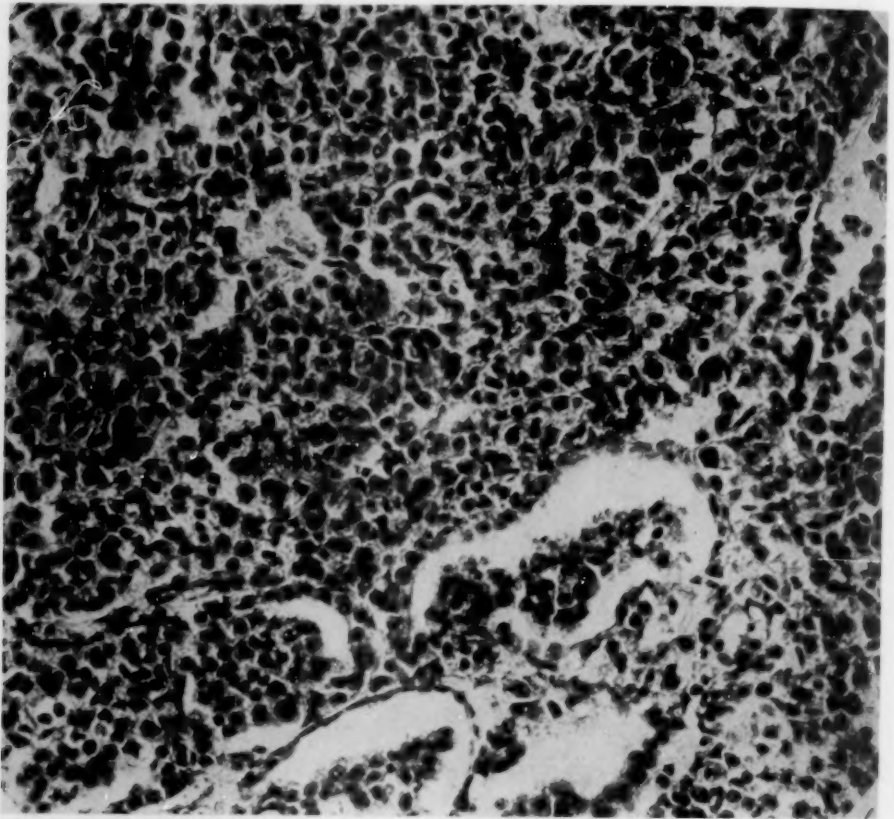


FIG. 2.—Structure of solid portion of tumor, showing diffuse or slightly alveolar growth of cuboidal cells.

large mass had disappeared, but the testis in this region was thickened. Epididymectomy completed.

September 30, 1927, the testis was found as large as before, and was then removed with the spermatic cord.

At the present time the patient is well and there is no sign of local or abdominal recurrence.

Gross Anatomy.—The testis, collapsed after drainage of fluid, measures 5 x 6 cm. The contour is rounded, smooth, tunica albuginea intact. On section, the tumor occupies about one-half of the glandular area, and mostly on one side, while the remaining half appears like normal testicular tissue. The upper half of the tumor resembles a very coarse sponge in texture, with extremely numerous fibrous strands inclosing very many small cysts. Some of the cysts are larger, 3 x 4 mm., and three are much larger, 1 cm. in diameter. Among the cysts are several solid opaque tumor areas. The tumor is well separated from the gland tissue by a fibrous capsule along the upper segments, but, below, the cysts and solid tumor merge insensibly with the gland tissue. The tumor is thus distinctly within the body of the testis and not in the rete, where the usual carcinoma of

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the testis arises. The rete appears free from involvement. The epididymis, removed at the first operation, showed no definite gross changes. It was examined microscopically by Doctor Symmers, who reported: Foreign body granuloma of epididymis.

The location within the body of the testis, and involving much of the organ, and the multicystic character, are features which distinguish the tumor sharply from the ordinary teratomatous carcinoma of this organ.

Histology.—Histological examination by Dr. Symmers: "Foreign Body Granuloma



FIG. 3.—Structure of area showing very many small cysts with papillary projections of stroma lined by flat cells.

of Epididymis." The structure of the tumor is peculiar and notably different from that of most testicular tumors. The cells are small, polyhedral, and very hyperchromatic, the nucleus filling most of the cell mass. They line the very numerous small cystic spaces in single rows or flat layers. There are numerous papillary projections of stroma in the cysts, all covered with one or more layers of epithelial cells, and these cells sometimes infiltrate the stroma. The tumor cells also form solid areas, in a diffuse or slightly alveolar structure. The stroma is adult in type and free from lymphocytic infiltration.

The remaining testicular tubules are atrophic, but many of them are filled with tumor cells. Spermatozoa are found in considerable numbers in many tubules, which are slightly altered. In places the lining cells appear very hyperchromatic and atypical suggesting that they are in process of transformation into tumor cells, but the derivation of the tumor from the tubule cells is not satisfactorily accomplished. It is possible that the suspicious tubules are being invaded by tumor cells from without. The tumor mass seems to replace rather than compress and displace the testicular tissue. In this

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respect the process is entirely different from the teratomatous carcinoma, which displaces and compresses the testis, and only occasionally invades it.

The general structure resembles that of the adenomas of Pick and Chevassu, but is much more cellular and anaplastic than these adenomas.

COMMENT

The present case presents clinical, gross anatomical, and histological features which separate it sharply from the common embryonal tumor of the testis. The age of the patient, fifty-one years, the slow course, and the absence of metastases after a long period, and in spite of a partial operation, indicate a different clinical condition from that which exists with the malignant embryonal tumors. The gross anatomy, showing a peculiar multicystic tumor arising well within the body of the testis and replacing the gland tissue instead of displacing it, is very different from that of the embryonal tumors. The structure marked by small cubical cells covering very numerous papillary projections of stroma and growing in diffuse or slightly alveolar form, is also markedly different from that of the embryonal tumors.

We therefore conclude that the tumor is not to be classed with the ordinary embryonal tumors of teratomatous origin, but is an adult anaplastic growth probably derived from the adult tubule cells.

We have never seen a tumor of exactly this type before, and therefore think they must be rare. Gordon Bell, however, describes four cases, three of which at least seem to belong in the present class of adult adenocarcinoma. They all occurred in subjects past the usual age of incidence of testicular tumors, and they grew slowly, remaining in the testis for as long as two and three years. The fate of the patients was not stated.

In view of all the data now available, it appears that there are two varieties of malignant carcinomas of the testis. The great majority, but not all of the tumors, are embryonal carcinomas of teratoid origin, which tend to appear at earlier ages, generally before forty years, grow rapidly, metastasize freely by both blood and lymph paths, and are highly radiosensitive. The other type is rare, appears generally after forty years of age, grows slowly, metastasizes less rapidly, is probably somewhat radioresistant, and should offer a better prognosis.

It should be possible to recognize many of these cases of slowly growing tumors of adult type on clinical data, and many more, if not all, should be identified on gross anatomical and histological features. It still remains to determine how numerous these tumors are, and whether there are other variants of the series of adult adenocarcinomas which can be separated from the embryonal carcinomas.

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CARCINOMA OF THE TESTICLE

BY JOHN EDWARD KELLEY

AND

WILLIAM C. HUEPER

OF CHICAGO, ILL.

FROM THE DEPARTMENT OF SURGERY AND OF PATHOLOGY OF LOYOLA UNIVERSITY AND THE LABORATORIES
OF MERCY HOSPITAL

Historical Data.—The earliest record of an attempt to study the nature of testicular tumors of probable malignant character is found in the work of Saint Donat. In 1696 he identified in a neoplasm from that site a rudimentary skull and pigmented ocular cups, and thus seems to have established in great measure the teratomatous origin of these tumors. In 1803 Prochaska found fetal units in a testicular neoplasm of malignant nature and in 1833 André de Peronne discovered hair, teeth and bones in a similar type of new growth. Later Johnsen established the tridermal character of malignant tumors of the testicle, and the investigations of Carling went far to demonstrate that their probable beginning is in the rete testis.

Frequency.—Tumors of the testicle are relatively rare. The great majority of them are malignant. Benign neoplasms are so rare that they are of very little clinical importance. Only a very small number of the different types of benign tumors are on record. Ewing¹ recognizes only two true adenomas of the testicle, and Rubaschow² collected three rhabdomyomas, two osteomas, one lipoma, ten fibromas from the literature and noted that enchondromas and hypernephromas are extremely rare. Among the malignant testicular neoplasms which represent 1-3 per cent. of all malignant tumors encountered in the human body (Bouchard and Laquière,³ Weiser,⁴ Morris⁵), the carcinomas are by far more frequent than the sarcomas. Only 4-10 per cent. of all testicular tumors are sarcomas. Rubaschow² mentions in his recent communication thirteen round-cell sarcomas, seven spindle-cell sarcomas and four polymorphous-cell sarcomas as reported in the literature. Endotheliomas are very rare. Tanner⁶ collected in 1922 about 600 cases of testicular carcinomas from the literature. The present number of published cases runs well over 700. Besides true tumors, teratomas and teratoids are found in the testicle from which benign as well as malignant tumors frequently arise. These formations can be arranged according to their frequency as follows: Carcinomas, teratoids, teratomas, sarcomas and benign tumors.

Etiology.—1. Heredity does not play an important if any part in the etiology of testicular carcinomas (Wesson⁷).

2. Sexual activity may have some relation to the origin of these tumors, as they occur most frequently during the period of the greatest vigor.

3. Previous testicular or epididymic diseases as tuberculosis, gonorrhoea, syphilis, are apparently without any etiological significance (Weiser⁴). tory in 20-30 per cent. of the cases (Wesson,⁷ Coley⁸). Chevassu⁹ states

4. Trauma is of a doubtful causative importance in spite of a positive history that it is overrated as an etiological factor and Weiser⁴ takes a similar standpoint in this matter. It has to be considered that trauma of the testicle is very common. By directing the attention of the patient to this organ the trauma may cause the detection of the preëxisting tumor. But in cases in which the development of a tumor follows the trauma several months later a relation between trauma and tumor formation cannot be absolutely denied, as testicular carcinomas grow rather slowly in the beginning. The more frequent occurrence of carcinomas in undescended testicles located in the inguinal canal is also mentioned in support of the etiological significance of the traumatic factor. It is asserted that the inguinal testis is subjected to frequent bruising against the pubic bone and compression by the contraction of the muscles of the anterior abdominal wall. But Weiser⁴ contends that the inguinal testicle is less exposed to trauma than the scrotal organ. It is, however, a fact that inguinal testes are more frequently the seat of carcinomas than the scrotal ones. While carcinomas are ten and threethirds times as often present in scrotal testes as in inguinal ones (Pearlman,¹⁰ Cunningham¹¹), only one undescended testicle is found to 500 scrotal ones, or malignancy in undescended testicles is fifty times as frequent as in scrotal ones. Rice¹² states a lower figure (1:15), but there is still a marked predominance of the carcinomas in the undescended organ. Trauma as represented by the contraction of the abdominal muscle occurring with coughing, lifting, etc. (Kahlden¹³), or torsion of the cord (Pearlman¹⁰), is regarded as a causative factor for the development of malignancy in testicles retained in the abdomen. Bulkley¹⁴ notes that one in every seventy-five abdominal testicles becomes malignant, or one in every four malignancies in undescended testicles is found in an abdominal one. Uffreduzzi¹⁵ and Keyes assert also that the abdominal testis is more likely to become malignant than the testis retained in the inguinal canal. Tanner,⁶ however, states that the testis located in the abdomen has the least tendency toward malignancy. Wesson⁷ and Keyes¹⁷ regard the present statistical data concerning the frequency of malignancy in abdominal testicles as inconclusive. Pearlman¹⁰ collected sixty-five cases of malignancy in abdominal testicles from the literature.

5. The importance of developmental disturbances of the testicle for the origin of cancers of the testicle is especially emphasized by Ewing,¹ Pick,¹⁸ Wilms,¹⁹ Ribbert²⁰ and others. Ewing contends that all carcinomas as well as the majority of other testicular neoplasms derive from teratoids which are highly potentially malignant. In these teratoids the tumor cells outgrow and suppress more or less the other tissue elements. Weiser⁴ also stresses the importance of this factor. He states that the affected testicle is often congenitally larger or smaller than the normal one, pointing to

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the presence of developmental disturbances in this organ. He holds also that the increased frequency of cancer in undescended testicles supports this viewpoint. Furthermore the occurrence of malignant growths in both testicles is highly suggestive of the existence and causative significance of pathological developmental conditions in these organs. Bland-Sutton²¹ mentions in 1923 that thirty-five cases of malignancy in both testicles were so far reported. Trauma probably may act as a contributory factor by activating the latent proliferative qualities of congenitally pathologic cells.

Origin.—Carcinomas usually start in the rete testis in the region of the junction of the upper part of the epididymis with the back of the testis. There exist two theories concerning the actual origin of testicular carcinomas. Langhans²² suspected and later Ewing, Wilms and others considered it a well established fact that testicular carcinomas are exclusively products of a one-sided development of teratoids. Ewing claims that a careful examination of the tumor frequently shows at times only very scanty traces of other tissues as cartilage, bone, nests of entodermal epithelium, etc., revealing the teratoid origin of the tumor (Morris,⁵ Hinman, Gibson and Kutzmann²³). Ewing supports his contention with the following reasons:

1. The characteristic structure of embryonal carcinomas is sometimes also observed in carcinomas of definitely teratoid origin.
2. He observed in a very early embryonal carcinoma minute traces of other tissues.
3. The rapid growth of the malignant embryonal elements gives unusually favorable opportunity for the overgrowth and suppression of other tissue elements.
4. The only known benign tumor of the adult spermatoblasts is very different from the embryonal carcinoma.
5. Against the origin of the embryonal carcinomas from spermatoblasts incited to growth by the presence of a teratoma the occurrence of extratesticular embryonal carcinomas (ovarian teratomas) (Zeitlin²⁴) has to be noted.
6. He could not substantiate the findings of Gordon Bell²⁵ who reported the observation of transitional stages between normal spermatoblasts into tumor cells as he was unable to rule out collateral hyperplasia and invasion of the tubules by tumor cells.
7. There does not exist an actual difference between the origin of embryonal carcinomas from primordial isolated blastomeric cells and primitive sex cells as both are omnipotent.

Chevassu,⁹ Debarnardi,²⁶ Schultz and Eisendrath,²⁷ Gordon Bell,²⁵ Frank,²⁸ Geist²⁹ and others, however, claim that a certain type of carcinoma which Chevassu named seminoma, Ewing called embryonal carcinoma, Schultz and Eisendrath termed spermatocytoma, originates from the adult spermatoblasts of the testicular tubules. They assert that the tridermoid character of embryonal carcinomas is not evident in the majority of the cases, that these tumors may occur associated with teratomas and that the differ-

ence in the age of incidence of seminomas and teratoid carcinomas, the former being more frequent in the third decade, while the latter are more frequently found in persons who are in their fourth decade, but also occur in babies as well as in old persons, point to a difference in character of these two new growths. Ewing admits the possibility that those clear celled carcinomas tending to form alveoli without definite embryonal character and without lymphoid stroma may belong into a separate class and originate from adult tubular epithelium as claimed by Chevassu. He concludes that in no other organ the principle of overgrowth of one element of a teratoma has been proved to be so predominant as in those of the testicle and while it is possible to carry this principle too far, the data seem to demonstrate its great importance in the interpretation of tumors of this region. Ewing does not completely deny according to this reference the origin of a certain type of testicular carcinomas from the tubular epithelium. Seminomas may originate, from an evaluation of the existing observations in our opinion, from teratoids as well as from the testicular epithelium. But the latter tissue is apparently less frequently the source of malignancy of the testis. There seems to us not sufficient evidence brought forward to deny to spermatoblasts any malignant blastogenic properties. Kaufmann³⁰ considers also the origin of testicular carcinomas from adenomas and germinative parts of Wolff's body.

Macroscopic Appearance.—The testicular carcinomas can be divided according to their macroscopical appearance into solid and cystic carcinomas.

1. Solid carcinomas are usually soft, rarely firm in consistency. The normal shape of the organ is usually preserved, but also a nodular surface may be occasionally seen. The testis is in general considerably enlarged in cellular tumors or may be rarely of almost normal size in fibrotic neoplasms of scirrhous type. On the cut surface they are often turbid, of yellowish white color and medullary, homogeneous, sometimes somewhat granular or glassy gray appearance without any definite texture. Hemorrhages and irregularly shaped yellow necroses which are frequently very extensive may produce a multicolored aspect of the cut surface. Atrophic testicular tissue may be present in the periphery of the tumor underneath the capsule.

2. Cystocarcinomas resemble multicystic cystadenocarcinomas or cystic teratomas of the ovary. But they involve also the epididymis which remains unaffected in teratomas of the testicle.

The epididymis is in general completely absorbed in the tumor mass. The time of invasion of this organ depends upon the size, the location and proliferative activity of the tumor. The tunica albuginea is rarely involved except in a late stage. The veins in the tunica albuginea are dilated and tortuous. Perforation through the skin with ulceration and suppuration is rare.

Microscopical Appearance.—The testicular carcinomas may be grouped according to their histological structure as follows:

1. Seminoma or spermatocytoma or embryonal carcinoma or incorrectly large round-cell sarcoma. 2. Adenocarcinoma with its papillary and gelatinous variety. 3. Squamous-cell carcinoma with and without cornifications and basal-cell carcinoma. 4. Neuroepithelioma. 5. Chorioepithelioma. 6. Carcinosarcoma.

1. Seminomas which constitute about 50 per cent. of the malignant testicular tumors are composed of solid nests of round or polygonal, large cells with a clear, glycogen containing cytoplasm and large, round, usually centrally located, hyperchromatic nuclei.

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They are in general arranged in smaller and larger alveolar or tubular formations which may rarely show a central lumen and are embedded in an interlacing network of loose connective tissue containing more or less numerous lymphocytes. Even definite lymph nodes may sometimes be present. Extensive necroses and hæmorrhages are frequently observed. The stroma is sometimes more abundant, the alveolar arrangement less pronounced and a more diffuse infiltrative proliferation of the tumor cells exists. In rare cases the lymphocytic infiltration is absent. The seminoma cells are highly sensitive to fixation fluids. If the tissue is not properly treated the cells shrink leaving a pseudointercellular substance. Other tissue elements as bone, cartilage, nervous cells, etc., pointing to a teratoid origin of the tumor are not infrequently found.

2. Adenocarcinomas are not as often observed as seminomas. Gelatinous adenocarcinomas are extremely rare. Papillary and solid formations are sometimes present in the same tumor. The adenocarcinomas show frequently a very delicate structure. They are found in very young as well as very old persons.

3. Squamous-cell and basal-cell carcinomas are rarely seen. The cornified type of squamous-cell carcinoma is very rare.

4. Carcinoma of a neuroepithelioma type are also very rarely observed. In these tumors oval and spindle-shaped cells surround in a radiating arrangement a small central lumen.

5. Chorioepitheliomas representing the typical or atypical syncytial type are rare. They are sometimes associated with embryonal adenocarcinoma. The primary tumor which appears as a dark red nodule is occasionally very small and may be overlooked during life time. Spontaneous regression of a testicular chorioepithelioma is suspected in cases in which a fibrous node in the testicle and extensive general metastases of a chorioepithelioma exist.

Metastases.—Carcinomas of the testicle form in general, very early and extensive metastases by way of the lymphatics and blood vessels. The vas deferens is rarely invaded and used as a way for the extension of the tumor. Very small testicular tumors which cannot be palpated may produce retroperitoneal metastases of enormous size (Prym³¹). By continuous growth in the lymphatics of the spermatic vessels the tumor cells may surround, compress and even invade the ureter and urinary bladder and infiltrate the perivascular tissue from the inguinal canal up to the renal hilum. By invasion of the spermatic veins the tumor cells may grow into the inferior vena cava and the right heart. Metastases by way of the blood vessels are found in the lung, liver, brain, kidney, etc. The metastasizing in the lymphatics occurs in two steps. The retroperitoneal lymph nodes located before the 3rd–4th lumbar vertebræ, left of the aorta and right between aorta and vena cava are first involved. They appear on palpation as unmovable masses which may bulge sometimes below the costal arch. After the perforation of the tumor cells into the thoracic duct metastases are observed in the left supraclavicular lymph nodes. From there the tumor spreads into the intrathoracic lymph nodes and by way of the blood into other organs. In carcinomas having the structure of a mixed tumor the metastases may reproduce the different tissue elements of the original tumor. Cylindrical-cell carcinomas sometimes form metastases after several years of latency.

Symptoms.—Malignant tumors of the testicle present very little in the way of subjective symptoms, especially in the early stage or before metastases have occurred. Pain is present in somewhat less than one-third of all cases

but it is not severe. It is, rather, of a dull, aching and dragging character, more noticeable toward the end of the day. It almost invariably disappears after a few hours in the reclining posture and is probably due to blood vessel engorgement and the pull of the increasing weight of the tumor. Objectively there is not much more. The tumor grows slowly at first and then rapidly, retains in most cases the normal oval outlines of the testicle, is generally smooth and moderately firm on touch and seldom involves the skin and fascia. The cord is not always thickened.

The secondary growths may be attended by symptoms peculiar to their respective localities. Pain and tenderness on palpation of the mass or masses are characteristic of metastases in the skeleton, especially in the cranium. Digestive disturbances and sometimes constipation are not infrequently noted when the retroperitoneal glands in the region of the celiac axis are involved. When, rarely, the brain is attacked there are characteristic findings of pressure, and when the lungs are invaded, or the thoracic glands, a rather persistent and annoying cough is likely to trouble the patient. Signs and symptoms of intestinal obstruction are sometimes met with when there are formed adhesions between the secondary growths and the small bowels in the upper abdomen. Hematuria and other urinary disturbances as tenesmus occur when the kidney is invaded or when the bladder is subject to pressure from growths, primary or secondary, in the lower abdomen or pelvis. Skin metastases are seldom painful and may escape unnoticed by patient and physician. They resemble sebaceous cysts and are frequently discolored.

In most cases, following early metastases, cachexia and loss of weight and strength appear, indicating that the inevitable outcome is not far away.

In the intraabdominal type, vague and, for the most part, ill-defined symptoms of pressure pain in the lower portion, followed later by the discovery of the tumor or tumors (in the bi-lateral cases) on examination constitute the principal findings.

Diagnosis.—This is usually not very difficult if the possibility of cancer is kept always in mind when examining enlargement of the testicle.

The differential diagnosis is probably seldom made, clinically, and if done, could have little if any bearing on the treatment or outcome.

There must be differentiated, however, the following conditions:

1. Inflammations. a. Orchitis, simple, traumatic. b. Orchitis and epididymitis, gonorrhœal. c. Gumma. d. Tuberculosis. e. Hydrocele. f. Hematocele (traumatic).

2. Neoplasms (testicle and epididymis). a. Benign tumors (adenoma, fibroma, osteoma, lipoma, enchondroma, etc.) b. Malignant tumors. I. Primary malignant tumors (sarcomas). II. Secondary malignant tumors (sarcomas and carcinomas).

3. Teratomas and teratoids.

ORCHITIS: This is generally co-incident with gonorrhœa or follows very shortly after trauma. There is greater pain and tenderness than in carcinoma.

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Increase in size is more rapid, generally a matter of hours or at most a day or two from the onset. There is more irregularity in outline of the mass and the epididymis is distinguishable.

GUMMA: Here a Wassermann test alone cannot be relied on, as a coincident syphilis and carcinoma might exist. Vigorous antisyphilitic therapy for a week's duration should cause the gumma to shrink to such a proportion as to establish its nature. Here also its irregularity in shape together with the probable indention of the epididymis as a separate mass should assist in the differentiation.

TUBERCULOSIS: A nodular, irregular tumor mass involving the testicle, epididymis and cord, together with a rise in temperature, especially in the afternoon, and the probable finding of evidences of tuberculosis elsewhere, quite likely in the seminal vesicles or in the pulmonary organs, should render the diagnosis not exceedingly difficult.

HYDROCELE: Transillumination should always be used when hydrocele is suspected. Sometimes the fluid is quite thick and translucency is not apparent. An exploratory incision may be necessary to clear up the situation. A hydrocele may, however, co-exist with tumor.

HEMATOCELE: This generally follows trauma after a short interval. The tumor cannot be transilluminated and is a boggy, not very firm mass. Here again an incision may be necessary to determine the nature of the tumor. If the blood is clotted or the clot has become organized, aspiration is useless. In hematocele, of large size, practically none of the structures on the side of the scrotum involved, can be identified. In those cases due to trauma, ecchymosis of the surrounding skin will likely be present. Where it is due to other causes, this, of course, will not be found.

BENIGN TUMORS: This condition is not commonly met with, at least when compared to malignancy of the testicle. The tumor would be of slow growth, obviously it would produce no metastases nor have any detrimental effect on general body health. Removal of the tumor and microscopic examination will establish its nature.

SECONDARY MALIGNANT TUMORS: These are very rare. The presence of the primary tumor and metastases in other organs will usually assure the correct diagnosis.

EPIDIDYMIC TUMORS, benign as well as malignant ones, are extremely rare. The testicle can be palpated and distinguished from the epididymis (Scholl³⁴).

TERATOMAS: They are in general nodular, slowly growing masses which do not involve the epididymis. Bony and cartilage tissue may be sometimes demonstrated in the tumor by a Röntgen-ray picture.

The differential diagnosis of carcinomas of the intraabdominal testicle needs special mention. Renal, intestinal tumors and those of the urinary bladder have to be considered. By Röntgen-ray examination of the respective organs the correct diagnosis will be obtained.

Malignant tumors of the testicle have many characteristics which would seem to be distinctive. They grow rapidly, once active, and definite increase in size has been noted. They are generally quite regular in outline and obliterate all of the usual distinctive markings on the side of the scrotum involved. They are usually without nodulation and for the most part firmer and harder than the benign or inflammatory growths. In doubtful cases, and they are all that to a certain extent, there should be no hesitancy in making an immediate exploratory incision and in removing, if need be, the tumor for detailed examination to establish its nature. Waiting for further developments in suspected cases is not only needless but may easily render all future therapeutic measures futile.

Treatment.—The treatment is essentially surgical and operative, supplemented frequently by deep Röntgen-ray therapy, radium application and in some instances (Coley) mixed vaccines.

The surgical procedures employed vary from simple castration to an extremely radical operation which aims at the removal of inguinal and retroperitoneal lymph nodes and in some instances the spermatic vessels.

Statistics on the results obtained from the employment of these measures, single or in continuation, show a wide range of variation. Regardless of method employed, it is generally conceded that early operation offers the only hope to the patient.

When simple castration alone is used it has been pointed out that the cord must be very carefully separated from the surrounding tissue and severed as high up in the inguinal canal as possible before the testicular tumor is handled in any way to avoid, it is contended, the spread of embolic particles into the circulation. It is asserted by many surgeons that castration in malignant tumor of the testicle is without therapeutic value.

A much more radical operation for the relief of the condition, suggested by Chevassu and employed rather extensively also by Wesson as well, consists in castration, as described above, together with the spermatic vessels with all the tissue (gland bearing) surrounding these vessels as well as that between them and the large abdominal vessels, including the lumbar lymph nodes. All this is removed in one mass, retroperitoneally, through an incision which extends from the scrotum to a point in the groin opposite the umbilicus. The peritoneal cavity is not opened. This operation is quite difficult, especially that portion of it which aims at the removal of the lumbar lymph nodes, and, in addition, has an immediate mortality rate of 10 per cent. (Chevassu) and 12.4 per cent. (Wesson). The latter and Cairns recommend it as the best procedure. It appears to us, however, in view of the fact that earlier metastases occur in glands much higher up than those removed in the procedure just described, that this operation cannot be considered, logically, as having a curative value. That, however, is a matter of individual opinion.

Röntgen-ray treatment, first employed by Beclère¹⁶ and used later by Zeitlin, Prym, Keyes, Weiser and others, with apparently highly satisfactory

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results, must be mentioned. The technic consists in pre-operative irradiation of the testicle with low voltage and post-operative high voltage irradiation of the abdominal glands. Weiser, however, thinks that this is not sufficient to prevent metastases or to check them in the abdominal lymph glands. Wesson takes a somewhat opposite viewpoint in that he believes that irradiation of the abdominal lymph glands is of value in checking metastases there, even from seminomas.

It would appear that there is a logical prophylactic phase which might be considered in dealing with the subject of malignancy in the undescended testicle. On account of the increased incidence of and the proneness to malignancy in the undescended testicle, especially when it lies in the inguinal canal, it would seem that many of them, especially in adults, might well be removed before tumor forms. This has long been our opinion and has frequently guided us in the management of uncomplicated undescended testicle.

Pearlman is not of this opinion, apparently, and especially advises against interference in abdominal testicle. Weiser, on the other hand, recommends the removal of undescended testicles if orchidopexy is not possible.

Undescended testicles in the adult human are nearly always aspermatic and spermatogenesis does not occur in the vast number of these in spite of the presence of mature germinal cells. Thus, in our opinion, there exists no valid reason for the retention, in the body, of these potentially malignant organs in view of the fact that endocrine disturbances cannot result from their removal so long as one functioning testicle is left.

Prognosis.—The prognosis in testicular carcinomas is not good, to say the least. It depends, largely, upon the location, extension of the tumor and its probable early and undiscoverable metastases, and in no small measure, upon its histologic type. Malignant mixed tumors offer a worse prognosis than pure tumors. Carcinomas in cryptorchid testes are usually inoperable and thus offer little hope. These cases with abdominal metastases have very little chance for recovery. Recurrent testicular carcinomas are always fatal and characterized by a notably rapid course.

Chevassu states that he saw no case die after the lapse of three years immunity, following operation. Other observers report the occurrence of metastases many years after removal of the primary tumor and these, in general, proved fatal. Great variations are observed in the percentages of cures obtained by the different authors.

Weiser obtained 24 per cent. of cures after castration; Hinman 15 per cent. after castration and 30 per cent. of cures after radical operation; Handfield-Jones, 59 per cent.; Rice, 46.5 per cent. in 144 cases (1899); Kober (1899) 8.17 per cent. in 144 cases; Chevassu (1906) 19 per cent. in 100 cases; Bulkley (1913) 5 per cent. in sixty cases; Codman and Sheldon (1914) 41 per cent.; Crowley and Martland (1919) 50 per cent. in thirteen cases, and Coley (1915) 28 per cent. The post-operative life in malignant tumors of the testicle is, according to Rice, 8.35 months.

ILLUSTRATIVE CASES

CASE I.—J. C., age thirty-three years, by occupation a truck foreman, entered Mercy Hospital March 2, 1928. He stated that he had come for an operation for the relief of a left-sided hydrocele.

He gave the following history: With the exception of an uncomplicated urethritis of short duration five years ago he had not at any time been seriously ill. He is married and has one infant child, living and well. His wife has had no miscarriages. In July, 1926, while inspecting the top of a truck, he slipped and fell, striking astride a steel ledge which ran along the bottom of the body of the vehicle. He experienced immediately severe pain in the left testicle but that was of short duration. During

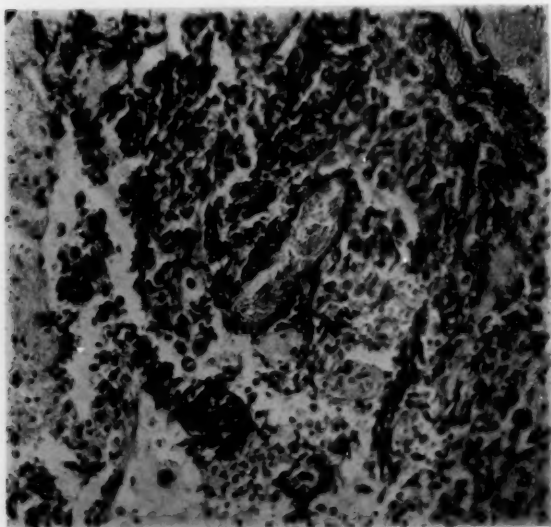


FIG. 1.—Case I.—Diffuse infiltration of pencil-cells into the nest of seminoma cells.

the next three days nothing of consequence occurred, but at the expiration of that time he noticed that the testicle was swollen but not painful. He thought that it was about twice normal size. He consulted a physician who prescribed some sort of lotion which the patient says reduced the swelling. He did not go to bed at this time but continued to do his work as usual.

About nine months later he began to observe a dull aching pain in the left testicle which increased gradually in severity and was always more pronounced at the end of the day and which, invariably disappeared after lying down for an hour or two. He stated that there was no apparent enlargement of the testicle at this

time but that it was appreciably harder. Very soon after this the mass in the scrotum began to increase in size, rather rapidly, reaching its peak in growth in February, 1928, at which time it had attained the proportions of a large egg. The character of the pain was still not severe but dull and aching. He had experienced no feeling of diminished health or strength.

A regional examination revealed an oval-shaped, fairly firm mass in the left side of the scrotum about the size of a goose egg. It was very smooth and not in any way irregular or nodulated, nor was it adherent to skin or fascia. The epididymis was not seen nor could it be palpated. There were no glandular enlargements in the inguinal region and the cord was not appreciably thickened. The mass could not be transilluminated, but neither can every tumor containing fluid. Pulse and temperature were normal and urinary findings were negative. A rectal examination was not made. A diagnosis of hydrocele, with probably thickened fluid, was made. As a purely precautionary measure it was suggested to the patient and his family that the mass might be a tumor and permission to remove it, if deemed advisable, at the time of operation, was obtained.

March 5, under a general anæsthesia, the skin and superficial tissues were opened in the usual manner and the mass was delivered. It was seen at once that the condition was not hydrocele. A stab wound with a small scalpel permitted the escape of a thin bloody fluid. The wound in the tumor was enlarged and the interior inspected. This showed it to be a solid mass, grayish-red in some places, grayish-yellow in others.

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There were areas of necroses and hæmorrhagic spots. It was removed together with the cord, the latter as high up as it could be done. The wound was closed without drainage. The wound healed by primary intention and the patient went home in ten days.

Pathological Report.—The testicle is 11.0 cm. long and 7.0 cm. wide, of oval shape and smooth surface. The organ is surrounded by a markedly thickened connective tissue capsule, which contains numerous diffuse hæmorrhages on the inside and which is adherent to the tumor in places. There is not a trace of testicular tissue or epididymis present as evident from an inspection of the cut surface. The tumor consists of nodes varying in size from that of a pea to that of a large walnut. They are separated from each other by a strong, white connective tissue stroma. Some are yellowish-white and of a homogeneous, bacon-like appearance, others more grayish, medullary, while the majority contains extensive hæmorrhagic parts and is of a granular or small cystic structure. The tunica vaginalis is invaded by the tumor tissue where adhesions exist.

The tumor is microscopically composed of very large, solid areas of large, round, clear cells with large, round, deeply stained nuclei. Mitoses are numerous. Diffuse infiltrations of the tumor cells into the stroma are frequently seen. Necroses and hæmorrhages are numerous and extensive. Slender, spindle-shaped or oval cells with elongated, spindle-shaped, hyperchromatic nuclei and a small amount of cytoplasm, either pointed on both ends or thickened on that end which points to the periphery of the carcinomatous cell nest. These cells invade the carcinomatous pegs from the periphery, being radially arranged, forming sometimes nets and splitting up the solid masses of carcinoma cells. In other places they crowd the centre of the strands where necrosis of carcinoma cells is present. These cells are apparently identical with the "pencil-cells" described by Lahm³³ in carcinomas of the uterine cervix. According to Lahm their presence indicates an attempt of the tumor toward a spontaneous cure. Hueper³⁴ could substantiate this assertion to that extent that cervical carcinomas which contain numerous pencil-cells show in general a better prognosis than those in which these cells are absent. The stroma of the tumor is fibrous and contains a moderate number of lymphocytes. The capillaries and smaller veins are often filled with solid plugs of carcinoma cells. In one of the numerous blocks examined, several small islands of bony tissue were seen in the stroma. An examination of the resected end of the cord revealed the presence of small nests of carcinoma cells in the pericardial tissue.

Diagnosis.—Seminoma originating from a teratoid.

Subsequent Findings.—The patient returned to light work four weeks following his operation. Four days later, while driving a truck, he developed a painless hematuria, intermittently for several days, during which time he passed several small worm-like clots which were inspected and which appeared to be ureteral casts. He was cystoscoped by a competent urologist whose findings and report were as follows:

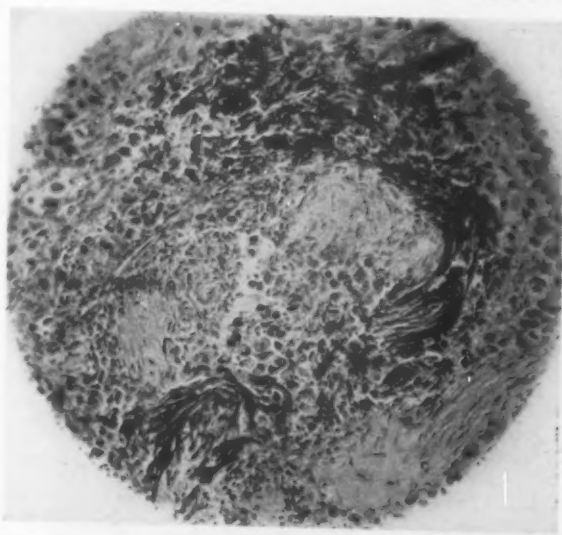


FIG. 2.—Strands of pencil-cells surrounding a degenerated centre of seminoma cells.

The veins of the trigone of the left side are rather prominent. The left ureteral orifice is pathological in that it appears as though it were elevated by something under the mucous membrane, which begins at the upper margin of the ureteral opening and is about the size of a large pea. The right ureteral orifice and the right half of the trigone are normal. Rest of the bladder is normal. There is no pulsation in the swelling, no movement. This gives a small shadow. It might be well later to remove this for histological study. Blood count: whites 8,200, hæmoglobin 95 per cent. Blood pressure: 140/88. Examination of the urine on admission showed no sugar, no albumin, blood, and many red blood cells in centrifuged specimen. A specimen on the day following cystoscopy showed two+ albumen and many red blood cells. Catheterization of the

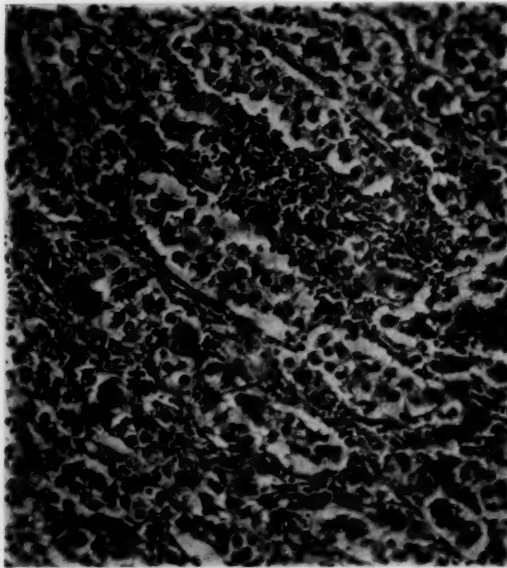


FIG. 3.—Case II.—Clear seminoma cells in alveolar arrangement imbedded in a lymphoid stroma.

ureters: No urine obtained from the left side. Right urine was free of pus, sterile upon culture and negative for tubercle bacilli. Bladder urine showed 50 pus cells and was sterile upon culture.

X-Ray and Pyelograms.—Right kidney outline normal; left not made out. Catheter on the right to top of third lumbar; on the left overlying the top of sacro-iliac. Overlying the upper end of left catheter is dense oval shadow, 7 mm. by 10 mm. This shadow can be seen on three films and strongly suggests stone. Injection of left catheter shows a normal filling up to this density but practically none of the pyelogram solution extending beyond it. Considerable of the solution has returned to the bladder. Right pyelogram shows kidney pelvis at the second lumbar, negative. Slight dilatation of the ureter at the level

of the fifth lumbar, otherwise pyelogram is negative. Some solution has returned to the bladder, particularly after the injection of left side. One line of this is curved with concavity downward. The lower border is sharply defined, the upper border not so well defined. This may be a second fluid level in the bladder because the bladder is pressed upon from behind by large prostate. The lower part of bladder shadow is more or less concave which also may be due to prostatic pressure. I think the essential pathology is that of stone in the lower end of the left ureter which is making complete obstruction. Beginning about May 1 he was given, on the advice of the urologist, for fifteen minutes, twice weekly, deep X-ray treatments in the region of the left loin and left kidney. The hematuria stopped immediately and had not reappeared on July 31.

He was examined on July 31, or about five months after initial operation. He felt, he said, well and strong and was of normal weight, 194 pounds. He had lost sixteen pounds during and just after his attack of hematuria but this had all been regained. There were two rather hard and somewhat irregularly oval shaped masses, close together but easily distinguishable, each about the size of a small olive, near the left external inguinal ring—undoubtedly local recurrences. In the left supra-clavicular space there was a group of enlarged lymph nodes, slightly adherent to the underlying structure and about the size of half a small apple, no doubt metastases. Other findings were negative.

An examination made August 3 revealed nothing new.

CARCINOMA OF THE TESTICLE

August 10 he again appeared for examination. He had lost two pounds in weight; hematuria had returned, though it is not constant; there is some vague digestive disturbance and a slight cough but no hemoptysis. He says he feels weaker and tires easily. There are some inguinal glands palpable on the right side and there is a small tumor, not seen before, under the skin of the back. This represents probably a metastatic growth. It resembles a sebaceous cyst and has a slightly bluish discoloration. It is not painful nor tender.

CASE II.—Man, forty-three years old, was operated on ten years ago for a right inguinal hernia which recurred three years later. The right testicle became swollen, hard, tender and irregular in shape after operation and an abscess formed and ruptured. Two weeks ago the right testicle started to swell again. Pain was continuously present in the organ. He was admitted to Mercy Hospital October 14, 1927, and subjected to removal of the testicle and high ligation and resection of the cord. Massive adhesions in the inguinal region originating from the previous herniotomy prevented further exploration into this area.

Pathological Report.—The testicle is 7.5 cm. long and 3.5 cm. wide. The normal shape of the testicle is well preserved. The surface is smooth and the tunica vaginalis is not adherent. On the cut surface multiple nodular formations of yellowish color and bacon-like appearance, or of more grayish-white color and delicate granular structure, are seen. Epididymic tissue is not present at the lower pole. At the upper pole of the tumor a bean-sized nodule of light brownish color and distinctly small follicular structure is observed. In one of the more centrally located tumor nodes a large, irregular, yellow necrosis is present. The lumen of the cord is plugged by a yellowish, homogeneous mass.

Microscopic Examination.—The tumor has an alveolar structure and is composed of smaller and larger solid, well demarcated nests and strands of large, usually round, sometimes more polygonal, vesicular cells with large round, distinctly stained nuclei. Mitoses are frequent. The loose connective tissue stroma forms a delicate network in which numerous lymphocytes are embedded. There are large necrotic areas. In some of the carcinomatous cell nests the tumor cells are apparently arranged around a small central lumen. The node with follicular structure present at the upper pole presents normal epididymic tissue with somewhat dilated ducts. In spite of the examination of numerous sections taken from various portions of the tumor no evidence of other tissues could be detected. *Diagnosis.*—Seminoma probably originating from the epithelium of the testicular ducts.

Course.—The patient was well and without any symptoms of his disease eight months after operation.

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ORCHIDOPEXY FOR VARICOCELE

A METHOD FOR TREATING VARICOCELE BY MEANS OF LIVING TISSUE

By WALDEMAR E. COUTTS, M.D.

OF SANTIAGO, CHILE

FROM THE UROLOGICAL CLINIC OF SANTIAGO UNIVERSITY

VARICOCELE, although a very common condition in men, is absolutely ignored by them in a large proportion of cases.

According to the various authors it consists in a varicose dilatation of the spermatic veins, although we have been able to demonstrate clinically that the dilatation affects both spermatic and epigastric veins; principally the latter group.

For a long time we had noticed by clinical examination of numerous patients that came under our consideration for the treatment of varicocele, that if we compressed under our finger the spermatic packet at the level of the external abdominal ring with patient in the recumbent position, on making him stand up without loosening our grasp of the veins, varicocele would be found in practically the same conditions as before the manœuvre.

Dissection also showed us that the epigastric veins do not penetrate the inguinal canal but run externally and under cellular layers.

As varicocele is a condition practically always observed to the left, and remembering the course that the left spermatic vein follows until it reaches the renal vein, we suspected that there existed no independence between the spermatic and epigastric veins, as in case this independence were effective the reflux from the spermatic being impaired by our digital compression, replenishment of varicosed veins would be very slow and we would not find varicocele in the same conditions immediately after a patient had changed his position.

We then tried to find an anatomical confirmation to our clinical supposition in dissection. Carefully injecting the spermatic vein with fuchsin-gelatine and the epigastric with methyleneblue-gelatine, M. Pinto found that both systems of testicular veins anastomose freely, especially around the caudæ epididymi.

Furthermore, lately we have had occasion to examine patients with recurrent varicocele after having been submitted to operation by methods that act only upon the spermatic vein (abdominal ligature), and who had experienced no improvement in their symptoms.

With the method we propose, we act in a simple manner by means of orchidopexy with living tissues on both venous systems and on the relaxed scrotum. We call it the method of the double pulley and it consists in:

First Part of Operation.—A skin incision that starting from the outer third of the symphysis pubis ascends obliquely upwards for four or five inches following the bisection of the angle formed by the median line and

Poupart's ligament. Cellular layers are cut through and edges of surgical wound separated by means of blunt separators. In the inferior part of the wound there appears the external abdominal ring and the venous packets penetrating under it; the shining aponeurosis of the external oblique occupies the superior part and the horizontal muscle fibres attached to the outer half of Poupart's ligament can be easily recognized.

From half to one inch above the arciform fibres of the external abdominal ring we make with the bistouri two short parallel incisions in the external oblique muscle fascia and pass downwards and under them a Kocher's forceps,

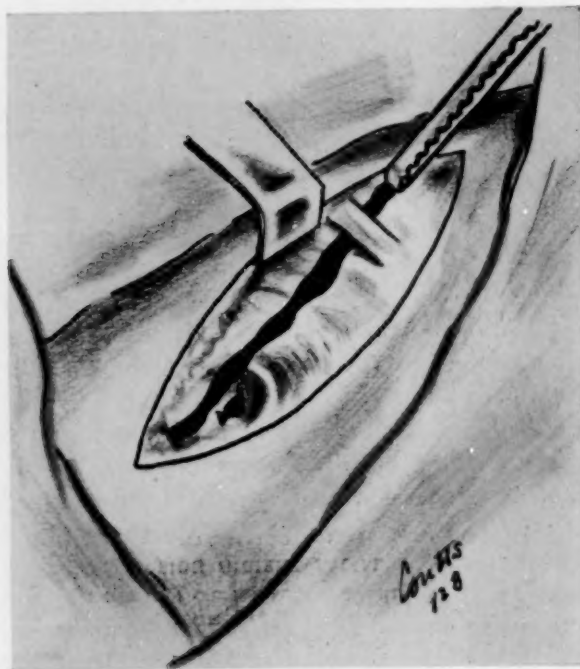


FIG. 1.—Forming the aponeurotic bridge.

forming in this fashion an aponeurotic bridge (Del Valle).

We next divide longitudinally the different covers of the spermatic cord and select one of the most dilated veins of the anterior or spermatic packet. After isolating it by means of blunt dissection and softly pulling it outwards and downwards, we cut it as far up as possible between two catgut ligatures. Once we have done

this we pull, by means of the Kocher's forceps, the glandular end through and under the aponeurotic bridge (Fig. 1).

Second Part of Operation.—Between the fibrous layer that continues itself upwards with the fascia transversalis and the parietal layer of the tunica vaginalis, we slip a soft Pean forceps down into the bottom of the scrotum. Pushing the testicle upwards we try and catch with the forceps the small crescentic fold of the tunica vaginalis that passes downwards to the bottom of the sac. We easily recognise if we have taken it between the forceps, because on pulling outwards the scrotum umbilicates. Holding the scrotum between our fingers we draw this portion of the tunica vaginalis softly outwards until it appears in the inferior part of the surgical wound. It can here be easily recognised owing to its smooth, brilliant serous appearance. With the bistouri we make a small incision through this portion of the tunica and pass a Kocher's forceps through the gap. By means of this forceps we grasp the vein that hangs over the aponeurotic bridge and drawing it downwards make it pass through this buttonhole.

ORCHIDOPEXY FOR VARICOCELE

Drawing the vein upwards we make it pass once more under the aponeurotic bridge. By drawing upwards or relaxing our hold on the vein we can leave the testicle at any height we desire. With a strong forceps we then crush under the aponeurotic bridge the different windings of the suspensory vein and passing a strong catgut suture under the block, finishing this part of the operation. We recommend a double ligature in order to insure complete success.

Under the aponeurotic bridge we place a catgut suture in order to join the fibres of the external muscle fascia. We close the surgical wound and place a suspensory bandage.

According to us, the first part of our operation, which resembles that of Del Valle only in the aponeurotic bridge made with the external oblique fascia, has an advantage over this method as it does not open the inguinal canal, a fact that surgically considered is of great importance.

We have so far operated over fifty patients, following our technique and the results so far obtained have been satisfactory. Some of our patients serving in the metropolitan police force, have been examined by us from six to ten months after operation and they were in perfect condition.

TRANSACTIONS OF THE PHILADELPHIA ACADEMY OF SURGERY

STATED MEETING HELD MAY 14, 1928

The President, DR. ASTLEY P. C. ASHHURST, in the Chair
CALVIN M. SMYTH, JR., M.D., Recorder

BONE RESECTION TO EQUALIZE LENGTH OF LEGS

DR. JAMES H. BALDWIN presented a man, aged fifty-two, who was admitted to the Methodist Hospital, November 13, 1925, with the history that while at work, a wire cable on a hoisting machine became looped around his right leg, pulling him up into the air and causing a comminuted fracture of the tibia and fibula. As the result of a fracture of the left femur eight years before, that leg had been shortened an inch and a half. Under the fluoroscope, the fragments were manipulated into satisfactory position, a plaster case applied and in a week the patient was permitted to go home. Shortly after going home, due to improper use of the leg, the case was broken. On returning to the hospital, the fragments were found to be in worse position than at the time of fracture. Open reduction was elected. Bearing in mind that the left lower extremity was one and one-half inches shorter than the right, it was decided to try and remedy this. Three-quarters of an inch was cut from the end of each of the four fragments. These could then be placed in perfect alignment. The fibula was sutured with kangaroo tendon and the

tibia plated with a Sherman plate. Later the wound became infected and the plate was removed. There was a discharging sinus for several months but this finally healed. At present there is a fusion of the callus between the tibia and fibula. However there is no deformity, function is perfect, both extremities are the same length, there is no limp.



FIG. 1.—Fungating fibroma of shoulder.

FIBROMA OF THE SHOULDER

DR. JAMES H. BALDWIN reported the case of a woman, age thirty-nine, who was admitted to the Methodist Hospital, July 26, 1927, with the following history: Three years before she had first noticed a small mass over

the left clavicle. She was then seen by the reporter, who at that time found a small freely movable painless mass about one inch in diameter. It was not

PRIMARY EPITHELIOMA OF THE GASTRO-HEPATIC OMENTUM

tender, was single and was not adherent to the skin. Removal was advised but this was refused. The growth slowly increased in size and finally broke down, becoming a large foul smelling, sloughing mass, irregular in outline and from which there had been numerous more or less severe hæmorrhages. X-ray studies showed no metastases in the bones or mediastinum. There was no cervical or axillary involvement. The biopsy disclosed the mass to consist of fibrous tissue with no evidence of malignancy. At operation, August 14, 1927, the whole growth was found to be between the skin and the deep fascia and was easily shelled out in one mass. Repeated microscopic examinations failed to find any evidence of malignancy. The patient made an uneventful recovery and gained twenty-five pounds in weight.

PRIMARY EPITHELIOMA OF THE GASTRO-HEPATIC OMENTUM

DRS. H. M. RIGHTER and HENRY K. SEELAUS, by invitation, reported the case of a colored woman, aged thirty-seven, who was admitted to the Philadelphia General Hospital, July 21, 1927, with an abdominal tumor.

In September, 1923, she was subjected to a complete supravaginal hysterectomy at another hospital, for a fibroid uterus, cystic ovaries and parovarian cyst on the left side. The history of the present trouble dates back seven years when the patient noticed a small lump in the left hypochondrium. It has gradually increased in size and consistency until it measured 12 x 8 x 6 cm. There had been a loss in weight of twenty pounds in the last nine months. For the past two years the woman has experienced episodes of severe abdominal pain associated with attacks of vomiting; since the mass in the abdomen has been increasing in size the attacks of pain have become more severe.

At operation, July 29, 1927, by Doctor Righter a large nodular tumor was exposed, which was thought to be between the two layers of the lesser omentum and apparently not connected with any viscus. The superficial leaflet of the gastro-hepatic omentum was incised and the mass rather easily extirpated. Because it was thought that the growth was malignant, 21 radium seeds of 45 millicuries strength were implanted in the bed of the tumor. The gall-bladder showed evidence of chronic calcareous cholecystitis, but because of the patient's general condition, nothing further was done. Convalescence was rather stormy for about a week, but after that her strength gradually returned and she was discharged from the surgical ward six weeks after operation. The patient returned in September, 1927, for post-operative X-ray therapy. Eight months after the operation, the patient is in excellent health attending to her household duties.

Pathological Report (Dr. F. J. Jodzis, from the Philadelphia General Hospital). "The specimen is an irregular, ovoid, encapsulated tumor measuring 11 x 7.5 x 5 cm., soft and fluctuating in some areas and firm in others and having smaller spheroidal nodules on its surface. Sections through the firm areas are grayish-white, homogenous, elastic and resembling fibrous tissue. Section of the softer areas shows gradations from reddish-brown to grayish-yellow gelatinous areas of myxomatous degeneration. Microscopic sections show the tumor mass to be encapsulated with a thick layer of dense fibrous tissue. Beneath this there are small and large nests of ovoid cells with a fairly deeply-staining, eccentrically-placed nucleus. The cells are uniform in size, the majority of them being arranged in an acinar formation and in some of the acini these cells take on a cuboidal or low columnar shape. They do not appear malignant, but resemble in some degrees the parietal cells of the stomach, also vaguely, the cells of the pancreas. Some areas show these cells in groups of two and three giving the impression that there is an invasion of the fibrous tissue. No mitotic figures were seen in any of the areas. Diagnosis: Adenoma of unknown origin."

Professor James Ewing of Cornell to whom sections were submitted, had this to say. "This is an epithelial alveolar tumor of very unusual structure. It is of glandular origin and malignant type. Its location suggests some relation to the pancreas and the structure is not inconsistent with that origin. It may arise from some aberrant island of gland tissue in this region where aberrant gland tissue is frequent."

Dr. B. L. Crawford, from the Jefferson Hospital, reported that sections from the tumor taken from different portions reveal slightly different pictures. In some areas there is extensive necrosis and in others there is considerable fibrous tissue with small clumps of cells scattered throughout, and in still others, the tumor is quite cellular, the tissue being composed of rather small, irregularly-shaped cells which are arranged to form indefinite acini and alveoli. The cells vary considerably in size and have large, deeply-staining nuclei. The cells forming the tumor are considered to be epithelial in origin and definitely glandular in type and while the cells somewhat resemble both liver and pancreatic tissue in places, it is thought that they probably more closely resemble the latter. However, there is nothing characteristic, such as epithelial-lined ducts or typical arrangement of the cells to identify the specific type of tissue. From the irregularity and variation in arrangement of the cells, the tumor is considered to be potentially malignant. Diagnosis: Epithelial tumor of aberrant gland tissue, probably undergoing malignant change."

A. Pearce Gould¹ at the beginning of the present century in his report of a "sarcomatous tumor of the gastro-hepatic omentum" was surprised that there were not more reports of primary tumors of the lesser omentum. At the present time, more than a quarter of a century later with the thousands upon thousands of laparotomies that have been performed, we can find the records of only two more.

Gould's patient was a man thirty-eight years of age who had a tumor removed from the lesser omentum. This tumor, weighed, when fresh, just over twenty-one pounds. The diagnosis, on microscopic section, was spindle-celled sarcoma. The patient made a good operative recovery and was free from recurrence more than four years later.

Murphy's² patient was a man of forty-nine who had a fibro-myo-myxoma telangiectatum which weighed thirty-four ounces. Clark³ reported a growth of the small omentum in a woman aged 60, but unfortunately no microscopic sections were made and there is no adequate description of the gross specimen.

In the previously reported instances of lesser omentum tumors there were found only connective tissue elements. The epithelial structures found in the growth reported in this paper very strongly favors, as suggested by Professor Ewing, an origin from an aberrant island of gland tissue, in all likelihood coming from either one of the primitive diverticula or evaginations which eventually become the adult liver and pancreas. Because the cells of this neoplasm bear a resemblance to the definitive pancreas, we incline to the view that it arose from one of the original ventral pancreatic diverticula, in spite of the fact that ducts were not found.

One of the striking things in connection with the symptomatology of these tumors is the tolerance that these patients show for the growing mass. Gould's patient had no severe local or general symptoms, except embarrass-

¹ Gould, A. Pearce: A Case of Sarcomatous Tumor of the Gastro-Hepatic Omentum. *Med. Chir. Gazette*, vol. lxxxiii, pp. 257-269, March, 1899-1900.

² Murphy, John B.: Fibroma of the Gastro-Hepatic Omentum. *Surgery, Gynecology and Obstetrics*, vol. i, pp. 315-319, October, 1905.

³ Clark, Jackson: Primary Tumor of the S. Omentum. *Trans. of the Path. Soc. of London*, vol. xliii, p. 60, 1892.

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ment of respiration and circulation from the mere bulk of the mass below the diaphragm. Murphy's patient had noticed the tumor nine years before and at no time were there any symptoms associated with it. In his own words, "If I could not feel it, I would not know I had it." Owen's patient, reported by Clark, had observed the growth for four years and her only complaint was pain due to the adhesions. The patient whose report is chronicled here is the only one who had any marked symptoms referable to the tumor.

In coming to a conclusion regarding the diagnosis, Gould considered retroperitoneal tumors, hydatid tumor, malignancy of the liver, splenic tumor or new growth of the kidney or adrenal. We would add to this list, malignancy of the stomach and pancreatic tumors. Pyelographic study and gastrointestinal X-ray would aid in excluding lesions of the stomach and kidneys. The long duration of the tumor with the absence of grave constitutional phenomena, such as vomiting, wasting, jaundice and ascites, would rule out malignancy of the liver. The more or less central position with the resonance to the left of the growth and the absence of constitutional symptoms, throws the diagnosis of tumor of the spleen into discard. The absence of fluctuation and the different outline are against hydatid tumor. The lateral mobility and the fact that it could not be separated from the liver would differentiate it from the retroperitoneal tumor. The long time the tumor was present, the absence of jaundice, digestive phenomena and the failure to lose weight, would invalidate the diagnosis of pancreatic tumor. The treatment is that which has been carried out in all of the reported instances, viz: Removal, and it might be worth while, as was done in this patient, to implant radium seeds into the bed of the tumor.

Dr. Righter remarked that it was in 1908 that Duane first suggested the burying of radium emanation directly in malignant growths, and that Janeway used the method which consisted of implanting glass "seeds", each containing one-half to one millicurie, within the tumor. The seeds were spaced about one centimetre apart. Some good results were obtained with this technic, but only too frequently it was followed by considerable necrosis and subsequent sloughing. While this result is undesirable in surface lesions, it is prone to be followed by fatal results in tumors within the peritoneal cavity. Hence, irradiation therapy of abdominal neoplasms had been confined largely to external radiation. Lately, however, a new procedure has been introduced which promises better clinical results.

This improvement consists in the substitution of gold tubes for the bare

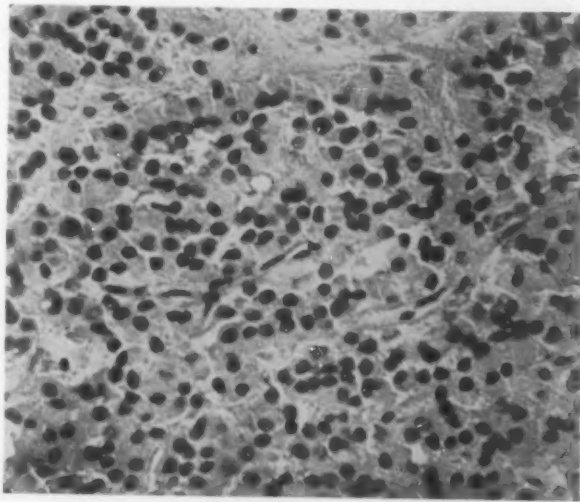


FIG. 1.—Photomicrograph of primary epithelioma of the gastro-hepatic omentum.

"seeds". By this means considerably larger doses can be concentrated within the limits of the tumor, and, on account of the greater screening effect of the gold, all but the most penetrating beta and gamma rays are removed, the tendency to necrosis and sloughing being very greatly reduced. From one to three millicuries may be used in these containers and the abdominal wound closed as soon as the implantation has been completed.

Levin in a paper published in the *J. A. M. A.* of January 28, 1928, reported four patients with carcinoma of the pylorus, one with carcinoma of the duodenum, one with carcinoma of the sigmoid and one with rectal carcinoma, all treated by the intra-neoplastic insertion of capillaries of radon plus the necessary palliative procedures, and, it is interesting to note that the insertion of the radon did not add to the hazard of the operation, and did cause a shrinkage of the tumor growth with a subsequent prolongation of life and comfort.

In the present case, twenty-one gold tubes, containing altogether 45 millicuries, were implanted in the bed of the tumor. This represents a dose of about six thousand millicurie hours. In addition a series of high voltage X-ray treatments were given at a later date. This latter treatment is now replaced, in some patients and in institutions having sufficient radium, by external irradiation with large radium packs containing from two to four grams of radium or its equivalent in emanation.

DR. GEORGE M. LAWS recalled a patient who had a tumor of the lower abdomen, which at operation was found to lie between the stomach and the transverse colon. The colon was pushed down in the pelvis and the omentum attached to the tumor. On enucleating, it was found to be quite friable and revealed cystic areas containing free fluid. The parietal peritoneum showed a great deal of irritation. This was a tumor of the gastro-colic omentum, separated from its attachments, enucleated and apparently no damage done to any important blood supply as the patient made a good recovery and was out of bed in two weeks. The pathological diagnosis of the tumor was fibrosarcoma.

BILATERAL ACOUSTIC NEUROFIBROMATA

DR. THOMAS A. SHALLOW reported the history of a woman, age twenty-four years, who was admitted to the Jefferson Hospital, in the service of Prof. Edward A. Strecker, December 30, 1927, complaining of headache. Loss of hearing in both ears, associated with head noises. Loss of vision in left eye, almost complete loss of vision in the right eye. Inability to walk. In her family history there was no history of malignancy, tuberculosis, diabetes, nervous or mental diseases.

Six years ago, one year after the birth of a child, she frequently experienced dull pain in the neck, associated with attacks of vertigo. These symptoms were aggravated when she stooped and recurred at intervals for four years. In 1926, it was noticed that she had bulging of both eyes, more marked in the left eye. Associated with the bulging there was some loss of vision in both eyes. Since March, 1926, the vision has become progressively worse. About this time her family noticed that she had difficulty in hearing; and she complained of hearing bells in her head and also complained of a buzzing noise. These symptoms persisted until December of 1926, when

BILATERAL ACOUSTIC NEUROFIBROMATA

there was some temporary improvement in her hearing, but since that time her hearing has become progressively worse. She did not complain of any headache until the latter part of 1926. Then she had attacks of severe frontal headache and vomiting. These spells would come on about once a month and would last from several hours to two days. Six months after their onset, these attacks abated and only recurred occasionally. At no time had she projectile vomiting.

Physical Examination.

—Vision. Right eye 22/100. Left eye no vision. Pupils 7 mm., react sluggishly to light; lateral nystagmus. Ophthalmic Examination.—O. D., media clear; disk very pale throughout; margins blurred; cup is obscured; veins tortuous throughout; arteries are contracted but fairly straight. O. S., media clear; disk intensely pale; disk is obscured; margins blurred. These conditions indicated optic atrophy bilateral, secondary to choked disk. There is very slight evidence of exophthalmos.

Head.—In the supraorbital region there were several small nodules the size of millet seeds. There were similar nodules on the scalp immediately above the hair line. There was a diminution of sensation in the left side of the face. Nose and Throat examination was negative except for pharyngitis. There was a slight enlargement of the thyroid gland. On the anterior surface of the chest there was a scar where a tumor had been removed one month before admission to the hospital. The nature of this tumor was not known. Heart and lungs did not show any evidence of pathology. There were no gastro-intestinal findings of importance. Menstruation was established at the age of twelve and had always been regular.

Extremities. Upper.—On the outer side of the index finger of the right hand were several nodules similar to those in the supraorbital region and on the scalp.

Neurological Examination.—Upper extremities. Superficial and deep reflexes present and normal. Grip and resistance good, no tremor present. No alteration in sensation of either hand. She is able to determine objects placed in her hands but there is slight delay in the right hand. Lower extremities. No ankle clonus or Babinski reaction present. Knee jerks present and normal. She swayed to the left when she attempted to walk,



FIG. 1.—Showing multiple tumors arising from acoustic nerve of each side.

and was unable to stand on either foot unassisted. Diminished sensation of the right leg on the outer half from the knee to the ankle. Slight rigidity of the right leg. The Barany Test suggested a lesion centrally located, involving the pons, more on the left side. There also appeared to be some involvement of the vermis, possibly from pressure. Fork Test.—Right ear, slight bone conduction, no air conduction. Left ear, slight bone conduction, no air

conduction. Weber's Test.—Does not hear fork when placed on the vertex of the skull. Rinne's Test.—Negative in both ears. Inflammatory disease of the ear was not found and there was no evidence that it had existed in the past.

X-ray Report of Dr. Leon Solis-Cohen.—"Study of stereoscopic image of the right side of the skull leads us to conclude that there is definite increase in intracranial tension as the stereoscopic films bring forth the greater prominence of the convolution markings of the skull. From these views also the sella turcica, while within normal limits, might still be con-

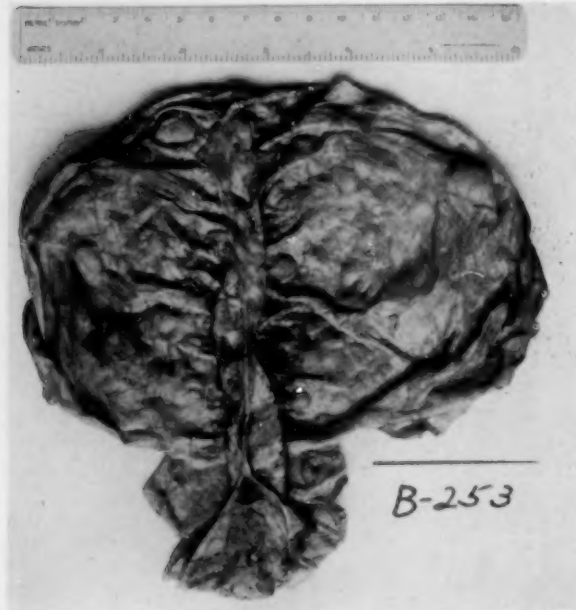


FIG. 2.—Showing the multiple tumors of the dura.

sidered deep. There is definite calcification in the mid-parietal region, presumably near the ventricles, presenting an irregular ear-shaped appearance, about one inch and a half by half an inch, that suggests the presence of calcification. The convolution markings are more prominent on the right side than on the left."

The diagnosis made in Professor Strecker's clinic was BRAIN TUMOR involving the eighth nerve.

Doctor DaCosta presented this case to his clinic on January 25, 1928. He stated, because of the bilateral absence of hearing he strongly suspected a multiple lesion, that is a lesion of both acoustic nerves instead of a single eighth nerve tumor. He diagnosed this case as a bilateral acoustic tumor and multiple neuro-fibromatosis. Doctor Shallow removed a small tumor from the scalp for examination. The laboratory examination showed that it was a neuro-fibroma.

A cerebellar decompression was done by the reporter on February 4, 1928, with the hope of saving the moderate vision which still remained. The patient died suddenly forty-eight hours after the operation.

Autopsy.—In the scalp and in the subcutaneous tissue over the trunk a number of small, firm, circumscribed nodules can be felt. These do not appear to have any distribution that follow in the course of the main nerves.

The dura is thickened and adherent to the piaarachnoid. On the inner surface of the dura there are innumerable small circumscribed, slightly elevated, firm gray nodules which protrude from the inner surface. These

BILATERAL ACOUSTIC NEUROFIBROMATO

nodules vary in size from a pin head to the largest measuring $1\frac{1}{2}$ cm. in its greatest dimensions. Several of these large nodules form definite depressions in the brain substance but are not adherent to the piaarachnoid. No nodules are observed in the piaarachnoid over the cortex of the brain.

The brain weighed 1360 Gms.; a number of definite nodules were observed at its base, two of the largest of these are in the cerebello-pontile angle, one on each side. Each one of these causes a depression, both on the pons anteriorly and on each lobe of the cerebellum posteriorly. The left tumor mass measures $4\frac{1}{2} \times 3\frac{1}{2} \times 3\frac{1}{4}$ cm. The right tumor mass measures $3 \times 2\frac{1}{2} \times 2$ cm. These tumors are quite similar. Both are adherent to the meninges and originated in the eighth nerve trunks. On the third cranial nerve

on the left side there is a small tumor mass about 3 mm. in diameter, definitely adherent to the trunk. In the Gasserian ganglion of the right side

there is a small tumor. The right and left of the seventh nerve both show a small tumor nodule attached to the nerve trunk. The right eighth nerve is included in a large tumor which extends into the internal auditory canal. The right ninth, tenth and eleventh nerves are included in the tumor mass, which extends into the right jugular foramen. There is slight destruction of the surrounding bone. All the ventricles are markedly distended with clear fluid. The specimen was preserved intact.

Histological Examination.—The tumor nodules in the dura and the base

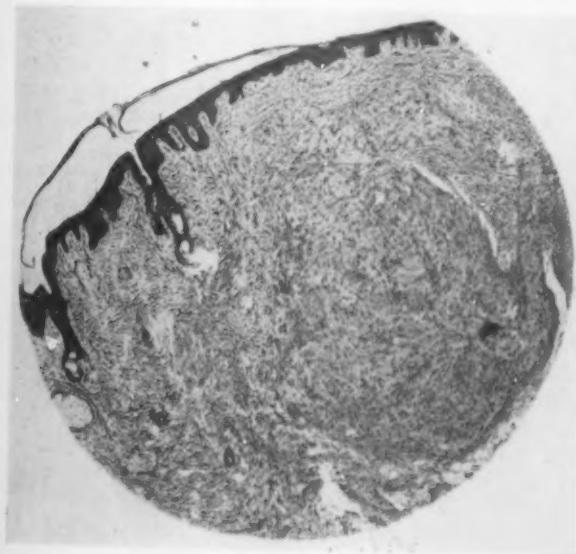


FIG. 4.—Microphotograph of the subcutaneous nodule removed before operation.

of the brain are similar in histological structure. They are composed of rather cellular tissue, the fibres of which show definite whorls. In some

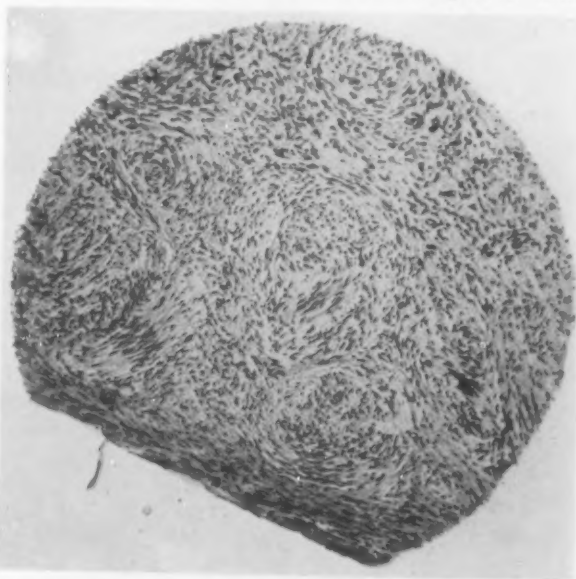


FIG. 3.—Microphotograph of the section of the tumor removed from the eighth nerve.

PHILADELPHIA ACADEMY OF SURGERY

areas the tissue is composed largely of spindle whorls while in other areas nerve fibres predominate. In some areas of the tumor spindle cells predominate. Some of the smaller nodules seem to arise from the nerve trunks in the meninges.

Anatomical Diagnosis.—Neuro-fibromatosis involving the subcutaneous tissues, the dura and the cranial nerves.

Histological Diagnosis.—Neuro-fibromatosis of the meninges and cranial nerves. Histologically the cranial tumors are similar in structure to the subcutaneous nodules which were removed before the cranial operation.

DR. FRANCIS C. GRANT said that he had seen three cases of von Recklinghausen's disease in the Frazier service at the University Hospital, one of which had bilateral tumors of the eighth nerve but no other cranial nerve involvement. The literature shows definitely that the eighth is the most common intracranial nerve involved in this condition. There appears to be no explanation for it. The second case had eighth nerve involvement, and operation was followed by recurrence on the opposite side two and one-half years later. Neither case had any peripheral manifestations of von Recklinghausen's disease. The third case did however and it came to necropsy which showed a condition similar to Doctor Shallow's case, only not so extensive. It showed single tumor of the acoustic nerve, entirely unsuspected, and von Recklinghausen's disease of the periphery. The operative difficulties in this case must have been extremely great as far as exposure of the growth was concerned. Even if the acoustic tumor could have been removed the others would have developed and the outcome would have been the same.

MUSCULO-SPIRAL INJURY COMPLICATING FRACTURE OF HUMERUS

DR. BERNARD H. NEUBAUER presented a man, age twenty-six, who September 16, 1926, sustained an injury to the left arm. There was marked deformity of the upper arm and a paralysis of the muscles of extension in the arm, forearm and wrist. X-ray showed a spiral fracture of the humerus through the musculo-spiral groove with displacement of the fractured fragments. September 17, 1926, an unsuccessful attempt at closed reduction was made. The wrist and hand were placed in a cock-up splint. October 5, 1926, open reduction was done; both ends of fractured fragments were isolated. The musculo-spiral nerve was lying directly in this path. The sheath of the nerve and several of the nerve bundles had been cut by the sharp point of the fragments. The nerve was isolated, the sharp pointed ends of the bones were removed and the fragments placed in apposition and secured with two wire nails. The soft fibrous tissue that had formed in the open area of the nerve sheath and nerve bundles was excised, and the nerve united by two catgut stitches placed in the sheath. The patient was placed in a plaster body and arm case with the wrist and hand held in extended position. The fracture united satisfactorily, the nails being removed thirty days after operation. Four months after the injury, the musculo-spiral nerve showed beginning return to function. This function has gradually improved to the present day now approximating 90 per cent. normal.

CRANIOPLASTY FOR CLOSURE OF DEFECT

DR. BERNARD B. NEUBAUER presented a man, age fifty-four, who was injured May 19, 1926. While he was using a wrench to drop the hopper on

CRANIOPLASTY FOR CLOSURE OF DEFECT

a coal car, the wrench slipped, whirling around and striking the patient on the right side of his head. He was knocked unconscious and taken to a hospital. There he remained four and one-half weeks—following an operation for decompression.

Five weeks after the accident when first seen by the reporter he complained of a feeling of emptiness in the open side of his head. He had headache, dizziness and nausea but did not vomit. Coughing caused the same sensations as the bending forward and both, seemed to the patient, to push the brain further out from the head.

Riding in street cars, especially when crossing car tracks, caused pain and discomfort. At times he complained of throbbing in the head. Lying in bed, with his head at a low level, gave him the feeling that his brain was pushing out, and he had an associated nausea. The patient was afraid that wearing his hat would injure his brain because his head felt so large when his hat was worn.

The physical examination showed a large defect in the calvarium of the right fronto-parietal area, 8 cm. in length and 6.5 cm. in width, of oval shape. The brain tissue was protruding and showed pulsation. There was no facial paralysis and there was no paralysis of the extremities on either side. The eye grounds and color fields were normal. The reflexes were equal on both sides.

The day following his first examination, the spinal pressure reading was 26 mm. of mercury. During the following six weeks the patient was given one 45 c.c. intravenous injection of 15 per cent. hypertonic saline each week; and one dram of magnesium sulphate was given before breakfast each day. By August 24, the hernia cerebri had receded to within the normal limit. The spinal pressure reading was 12 mm. of mercury.

August 26, a piece of cardboard was placed over the open space in the skull and adhesive used to hold it in place. A head bandage was applied. This procedure was adopted to ascertain what symptoms, if any, might develop from closing the defect. The patient reported that he felt better with the opening covered—and after a six weeks trial, it was decided to make a permanent closure.

October 12, Cranioplasty was undertaken. A large horseshoe incision was made, to include, both the defect and the area from which a graft was to be removed. Considerable difficulty was experienced in separating the scalp from the underlying dura, especially at the several points where the brain tissue had protruded through the dura. All openings in the dura were sutured. The eburnated bone formed about the opening was removed. A pattern of gauze, of the required dimension, was placed upon the exposed area from which the graft was to be cut. When about one-third of the graft had been chiseled free, the anæsthetist was advised that patient's condition had been gradually becoming worse and that pulse was about 140. The operation was discontinued and the flap sutured. The patient was returned to bed and treated for shock.

November 23, the second stage of the operation was undertaken. This time a horseshoe flap incision was made over the defect only. The scalp was very easily separated from the underlying dura which was found entirely closed. The edges of the bone were curetted.

Having decided to use a transplant from the tibia an osteo-periosteal graft was removed from its internal surface. The graft was in three parts, each 10 cm. long by 2.5 cm. wide. The three strips were placed with their lengthwise edges together and the ends resting upon the edge of the defect. The excess graft was removed to conform with the contour of the opening.

The periosteum was sutured to periosteum both in the graft area and to the periosteum covering the skull. The skin flap was closed without drainage.

Two and one-half weeks later, the graft area felt solid to the touch. The subsequent X-rays show a gradual increase in density of the grafted area to the present point of solidification.

DR. J. S. RODMAN said that the König-Mueller technic of using the outer table of the skull in the closure of cranial defects has always resulted in more or less severe shock in his experience. One patient, a child, died of shock. The use of a graft from the tibia as done by Doctor Neubauer in this case, seems much less likely to result in shock in that the necessary hammering and chiseling that goes on in order to raise such a flap from the skull is obviated. It is this repeated trauma to the head which results in the severe shock which it is so usual to see when the flap is taken from the outer table of the skull. An additional advantage is that time is saved because the assistant can raise the flap at the same time that the defect in the skull is being prepared to receive it.

CANCER OF THE TONGUE AND FLOOR OF THE MOUTH

DR. GEORGE M. DORRANCE and DR. JAMES K. MCSHANE (by invitation) read a paper with the above title for which see page 1007. To illustrate their paper, the essayists presented three patients, as follows:

CASE I.—A man, age sixty-seven, was admitted to the Philadelphia General Hospital, September 16, 1926, with a growth involving the left floor of the mouth. There was no demonstrable adenopathy in the neck at that time. Biopsy resulted in the diagnosis of prickle-cell cancer. He received four series of neck radiations; the local condition was treated at first with bare tubes and later with gold tubes. He is in good health today and free from all evidence of cancer.

CASE II.—A man, age seventy-four, was admitted to the Philadelphia General Hospital, January 21, 1926, with a lesion involving the under surface of the tongue and floor of the mouth. Biopsy showed prickle-cell cancer. There were four palpable glands in the right side of the neck beneath the sternomastoid muscle. The neck was treated by radium packs and the local lesion by 25 bare tubes in the tongue area for a total of 1830 mc. hours. Two years and four months after his first treatment he is free from all evidence of cancer.

CASE III.—A man, age seventy-three, was first seen by Doctor Dorrance June 25, 1923, at which time he had a squamous-cell carcinoma, which extensively involved the floor of the mouth, frenum of the tongue and mucosa of the lower jaw. His treatment which was commenced in June, 1923, and continued until June, 1926, consisted in all, of sixteen of bare tubes in the lesion. For all he had 61503 mc. hours radiation. At present he is free from all evidence of cancer.

The charts showing the total radiation and saturation curves for the above patients are included in the body of the paper.

DR. DAMON B. PFEIFFER asked whether Doctor Dorrance had given up bloc dissection of the neck in metastatic involvement. Not one of these cases was cured by radium; might they not have been helped by bloc dissection?

DR. A. P. C. ASHHURST said that some years ago Doctor Bloodgood pointed out that the only patients with cancer of the tongue or floor of the mouth whom he had been able to cure had been those whose disease was so far

PRIMARY EXTRARENAL HYPERNEPHROMA

advanced when first seen that it was necessary to dissect the neck, the floor of the mouth, and the glands in one piece. In later years Doctor Bloodgood has announced that no case with metastases in the neck is worth operating on at all; since they all die. Doctor Ashhurst desired to ask Doctor Dorrance which view he thinks to be correct. Doctor Ashhurst also desired to know, when Doctor Dorrance speaks of ligation of the external carotid, whether he means merely ligation or whether he really means excision, in Dawbarn's sense. Doctor Ashhurst had found mere ligation of little effect in checking the blood supply because the collateral circulation is very free. However, if one doubly ligates the external carotid at the bifurcation and then doubly ligates the superior thyroid, the lingual, facial, posterior auricular, occipital, internal maxillary, and temporal arteries, and excises the trunk of the external carotid thus set free from all its branches, very little collateral circulation can develop, and if this operation is done on both sides of the neck simultaneously, or at intervals of a few days only, then the malignant growth is really starved; œdema will subside, and the patient will be temporarily relieved. If the growth invades the upper part of the neck it may be impossible, of course, to expose the external carotid as high up as its division into internal maxillary and temporal arteries. Under such circumstances Doctor Ashhurst had excised the lower part of the external carotid and ligated the main trunk as high as possible, and then doubly ligated and divided the temporal artery above the zygoma. He had observed in a few of his earlier cases, that where simple ligation of the external carotid had been done on one side of the neck, only, pulsation returned across the scalp by way of the temporals in a couple of days.

DR. GEORGE M. DORRANCE said that as the collateral circulation is so rapidly established after ligation, he now excises a portion of the artery. In cases with involvement of the glands of the neck, the speaker has never effected a cure by radiation or excision. Bloc dissection carries such a high operative mortality that it is rarely justified, in view of the unsatisfactory results. Regarding the results with radium, the speaker added that some cases are radium sensitive; some give good results in treatment and some do not. He believes that he gets better results from the introduction of radium than from surgery; the primary mortality is less and the time in the hospital is less. The best results were in cases where a positive biopsy was not obtained. It is remarkable the number of patients that are sent to the clinic with the diagnosis of cancer in whom biopsy reveals a benign lesion.

PRIMARY EXTRARENAL HYPERNEPHROMA

DR. ALBERT E. BOTHE, by invitation, read a paper with the above title, for which see page 1028.

TRANSACTIONS

OF THE

NEW YORK SURGICAL SOCIETY

STATED MEETING HELD MAY 9, 1928

The President, DR. FRANK S. MATHEWS, in the Chair

SLIPPING PATELLA

DR. GUILFORD S. DUDLEY presented a woman, twenty-five years old, whose complaint had been dislocations of both patellæ. Such accidents always occurred either as the result of a slight miscalculation while walking or while descending stairs, resulting in a fall to the ground. She had always been able to manipulate the bone back into position and to resume walking immediately. The involved knee, usually the left, then felt weak for a few days but never became swollen. Past history stated that she had been dragged along the ground by both feet when about seven years of age, but was negative for anterior poliomyelitis or other serious illness. Her sister also showed unusual mobility of both patellæ, but had never had any dislocation.

Examination showed marked lateral mobility of both patellæ and the ability of the patient, by contraction of the quadriceps, to voluntarily dislocate the left patella laterally. This seemed to be due, at least in part, to the pull of the lateral portion of the quadriceps (*vastus externus*), since inspection and palpation of the thighs showed a distinct lack of rounded contour on the antero-medial (*vastus internus*) aspect of the left thigh, and comparatively little pull by this portion of the muscle. The circumference of this thigh was more than one inch less than that of its neighbor, but both calves showed equal measurements.

At operation, October 31, 1927, the procedure described by Soutter was carried out. A tunnel was drilled through the patella and through the inner tuberosity of the tibia at an angle of forty-five degrees, with the transverse plane of the knee-joint and a strip of fascia lata passed through these tunnels to anchor the patella in place. In addition, the marked laxity of the capsular structures on the inner aspect of the joint was improved by a continuous suture of chromic catgut. Since operation there has been no recurrence of the patellar dislocation and the stability of the knee-joint has been greatly improved.

GASTRO-JEJUNAL ULCER

DR. GUILFORD S. DUDLEY presented a man who, when first admitted to the Second Surgical Division of Bellevue Hospital in June, 1923, was fifty-six years of age. At that time he gave a history of recurring attacks of upper abdominal pain with loss of weight. Examination showed distinct tenderness in the right upper abdominal quadrant but no other abnormality. Radiographic examination was negative for duodenal ulcer but did show a deformity suggestive of periduodenal adhesions consequent to gall-bladder disease. At operation there was found a duodenal ulcer adherent to the under surface of the liver. Upon division of this adhesion there took place a minute perforation of the ulcer, which was closed by purse-string sutures. A posterior gastro-enterostomy was then performed.

PSEUDO-CYST OF THE PANCREAS

He was well until the latter part of 1925 when he was injured in an automobile accident, and dated the recurrence of symptoms from that time. Radiographic and fluoroscopic examination showed a well-functioning gastro-enterostomy stoma but no other abnormality. Despite this his symptoms persisted and he continued to lose weight. By October, 1927, he had lost forty pounds with a corresponding diminution in strength. Repetition of gastro-intestinal fluoroscopy and X-ray films was again negative. Early in 1928 he suffered an acute profuse gastric hæmorrhage and was taken by ambulance to another hospital where still another X-ray examination was found to be negative. Following rest and dietetic treatment he gained twenty pounds' weight and was readmitted to Bellevue Hospital ten weeks later for observation.

After careful fluoroscopy the röntgenologist was willing to report that a persistent fleck was visible in the region of the stoma and that this finding was suggestive of the presence of a gastro-jejunal ulcer. The X-ray film, however, did not show any lesion.

The interesting feature of this case rests in the many negative X-ray reports and the somewhat doubtful nature of the diagnosis at present. If the source of his recent and only gastric hæmorrhage in five years was a gastro-jejunal ulcer, what are the probabilities of its repetition? Should his age and his improvement following dietetic influence one's judgment with regard to operative treatment?

DR. JOHN A. MCCREERY said that he had under observation a patient with an almost similar history. The man had complete absence of symptoms until one month ago, since which time there has been marked loss in weight and two or three extensive hæmorrhages but almost no pain. Doctor McCreery's impression is that he has a marginal ulcer and, because of the extensive hæmorrhages, he plans an exploratory operation. Doctor MacGuire reported a case a year or so ago of marginal ulcer with such serious hæmorrhages that it was considered perilous to touch him but finally operation was performed to save life and resulted satisfactorily.

DR. SETH M. MILLIKEN said that he had a patient who in 1910 underwent a gastro-enterostomy for duodenal ulcer. He was admitted to Bellevue Hospital in March, 1913, for a very severe hæmorrhage without apparent cause. The patient was in such bad condition that no operation was done, but he was kept under observation and medical treatment was carried on for four weeks. He improved and refused exploration. He was seen at intervals after that for ten years, during which time he had had only one small hæmorrhage three years after leaving the hospital.

PSEUDO-CYST OF THE PANCREAS

DR. GUILFORD S. DUDLEY presented a man, thirty-five years of age, shown through the courtesy of Doctor Hartwell. He was injured in an automobile accident in February, 1926. The region of his left upper abdomen was struck by the ball of the gear-shift lever. Ecchymosis and local tenderness persisted for about one week but he had no further symptoms until November, 1927.

Since that time four attacks of severe upper abdominal pain have occurred. Obstinate constipation and persistent vomiting accompanied every attack, suggesting the possibility of an intestinal lesion. A gastro-intestinal series of X-rays proved to be negative. Accompanying the first attack jaundice

appeared and persisted for about two weeks, but did not occur with any of the subsequent attacks. Following the fourth attack (February 1, 1928) the patient noted an upper abdominal mass for the first time. Throughout the period of illness there was a loss of about fifteen pounds' weight but no other noteworthy symptoms.

Examination showed a visible mass in the left upper abdominal quadrant extending from the midline outward for two to three inches. Palpation and percussion gave the impression that the mass was globular and cystic and led to the pre-operative diagnosis of pancreatic cyst.

At operation, February 17, 1928, there was found presenting through the gastro-hepatic omentum a thin-walled irregularly spherical cyst containing about one pint of clear, slightly brownish-colored fluid. The lining membrane was smooth everywhere without any suggestion of new growth. Because of the impracticability of removal, the cyst was evacuated by aspiration, marsupialized, and a fragment of its wall excised for histological examination. The fluid was alkaline and contained trypsin. The cyst wall was lined by smooth fibrous tissue thrown into papillary folds with no evidence of malignant change.

Following operation, cicatrization rapidly transformed the cyst cavity into a fistulous tract. From this a thin, skin-digesting fluid drained continuously for six weeks, since which time the tract has closed three times and reopened twice. It has now remained closed for three weeks. No dietary restrictions have been imposed and the only effort employed locally to hasten healing was an instillation of six-per-cent. silver nitrate into the fistula. Since the cessation of drainage the patient has had two or three twinges of upper abdominal pain following exercise but no other symptoms. He has regained his weight and general feeling of well-being.

He is presented to the society because of the interesting association in his history of the two usual causes of pseudo-cyst formation. Probably, however, the lapse of twenty-one months from the time of injury to the onset of symptoms would rule out trauma as the etiological factor and lead to the assumption that his four attacks of upper abdominal pain were, in reality, attacks of acute pancreatitis which resulted in cyst formation.

DR. NATHAN W. GREEN said that with the history of injury one might naturally think the condition had its inception then, but the interval of twenty-one months before the appearance of the symptoms would incline one to doubt this. The speaker did not see why, however, it would not be possible for a hæmorrhage to have occurred during the injury, and a small amount of pancreatic juice set free to digest the extravasated blood and to form a cyst which showed its presence only twenty-one months later. The speaker had had a case, though with no history of injury, but with the same pathology. On operating there was found a pseudo-cyst of the pancreas which seemed to be subsiding after an inflammatory condition.

ENDOTHELIOMA OF THE PERITONEUM

DR. GUILFORD S. DUDLEY presented a woman who when first admitted to the Second Surgical Division of Bellevue Hospital in May, 1922, was twenty-one years old. She complained of a right inguinal hernia. At that time she gave the history of having had pleurisy in 1918, and of having been diagnosed as suffering from tuberculous peritonitis in 1921, because of the

ENDOTHELIOMA OF THE PERITONEUM

presence of free fluid within the abdomen. Although examination revealed no evidence of tuberculosis her hernia was repaired under local anæsthesia.

She was readmitted to the hospital in July, 1922, complaining of indefinite lower abdominal pain and abdominal distention. The pre-operative diagnosis was tuberculous peritonitis. The peritoneal cavity contained about 3000 c.c. of clear fluid and in its pelvic portion was a collection of light red, coagulated, jelly-like material. The visceral and parietal peritoneum wherever seen was studded with miliary masses. The uterus, tubes and ovaries seemed to be less involved than adjacent structures and could be excluded as the primary focus. The appendix appeared to show greater involvement than any other structure. It was removed and the abdomen closed without drainage. Histologically the serosa of the appendix showed thickening by a growth of cells resembling endothelial cells and the pathological diagnosis was given as pseudo-myxoma peritonei.

By October, 1922, her abdomen had again become distended with fluid. Laparotomy evacuated about a gallon of thick, yellowish, sour-odored fluid. All visible coils of intestine were matted together by a heavy fibrinous exudate which also tended to form a diaphragm separating the pelvic from the general peritoneal cavity. A piece of the greatly thickened parietal peritoneum was excised; a culture was taken and the abdominal wall closed with drainage to the right lower abdomen. Pathological diagnosis was subacute productive peritonitis and the culture showed a non-hemolytic streptococcus. Drainage persisted for six weeks.

In October, 1923, February, 1924, and October, 1924, she received X-ray therapy to the abdomen. Menstruation stopped after beginning of this treatment and in January, 1925, her abdomen was opened for the third time because of pain and reaccumulation of fluid. Fully a gallon of soapy, opalescent fluid was evacuated. The left tube and ovary were matted together in a cystic mass and were removed. Microscopic examination showed the general structure of an adenocarcinoma of the peritoneum. Review of the slides from the appendix showed precisely the same type of growth and the former diagnosis of pseudo-myxoma was withdrawn. The origin of the adenocarcinoma could not be determined.

In May, 1925, X-ray therapy was again administered and in June, 1925, two gallons of clear amber-colored fluid was evacuated from her peritoneal cavity by laparotomy. The intestines were remarkably free from adhesions. All omental fat was absent, and all that remained of omentum were its blood-vessels. The lowermost margin of these vessels was held together by a mass of tumor tissue, this creating the impression of a rope portiere.

Her fifth laparotomy was performed in November, 1926, at which time two gallons of amber-colored fluid were again evacuated. Many nodules were palpable in the mesentery of the small intestine and the surface of the liver was of a granular peppery feel. The serosa of the intestines and the parietal peritoneum appeared congested but did not show the miliary nodules formerly observed. One small pedunculated nodule was removed from the surface of a loop of small intestine.

Examination of this specimen showed, in places, the same gland-like arrangement noted in former specimens but for, by far the greater part, the tumor cells were diffusely arranged so that the impression gained was that of an hypernephroma. However, a diagnosis of hypernephroma was not justified in Doctor Symmer's opinion because of the notorious fact that metastasizing tumors not infrequently change in their morphology. In his review of all the sections from this case, he was inclined to the impression

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that it represented a so-called mesothelial carcinoma or endothelioma arising in the peritoneum itself.

Between November, 1926, and the time of her sixth laparotomy in June, 1927, the patient had four more X-ray treatments. At this operation six quarts of greenish-yellow fluid were evacuated. Since then there has been no reaccumulation of fluid and the patient has been in good general health. Since January, 1924, she has taken ovarian extract from time to time for the control of symptoms due to her artificial menopause.

POLYPOID ADENOCARCINOMA OF THE JEJUNUM WITH ACUTE INTUSSUSCEPTION

DR. NATHAN W. GREEN presented a woman, age thirty-four, who was admitted to Surgical Division A, St. Luke's Hospital, June 25, 1927. Her chief complaint on admission was nausea and vomiting for two days previous to admission. Present illness started twenty-five days previous to admission, when she returned from an outing with a heavy cold which lasted for some days. She then was taken with severe cramps in her abdomen. Previous to this she had been on a special diet for a "nervous stomach" for two years. She had become a shadow. Two days before admission, after a gastro-intestinal röntgenogram, she was taken with constant nausea and vomiting, until in collapse she was rushed to the hospital. She stated that abdominal cramps were constant and indescribable. Her gastro-intestinal history showed her to have had a fair appetite and to have been constipated since coming to America in 1920. A fruit diet corrected this somewhat.

On examination she presented the appearance of a poorly developed woman who appeared acutely ill. Abdominal examination showed the following: Scaphoid in appearance with a mass about the size of a potato, which could be palpated in the midline just above the symphysis. There was moderate tenderness in this area as also in the right lower quadrant where there was some spasm. Pelvic examination revealed the uterus enlarged and on its posterior wall a hard firm small mass. Rectal examination was negative. The pre-operative impression was fibroid of the uterus, partial acute intestinal obstruction. Upon opening the abdomen, starting about four feet from the ligament of Treitz, there was an intussuscepted mass about sixteen inches long, the outer loop being 6 cm. in diameter. The outside loop of the intestine was red, but no evidence in the intussuscepted loops of gangrene. After the reduction of the intussusception a movable mass about the size of a bantam's egg was felt within the intestine, apparently on a pedicle which could be pulled up and down for a distance of about 4 cm. either way. The intussusception, which appeared to be inverted three times, was reduced and the polypoid mass felt. About five inches of gut with the mass was resected. The ends of the sectioned gut were tied with chromic gut and inverted. The anastomosis was then made by the side-to-side method, the new stoma being 3 to 5 cm. long. Chromic continuous suture was made going halfway around each way for the first suture and this was reinforced by interrupted silk.

The post-operative convalescence was somewhat complicated. The patient was very ill for about a week and on the eighth day the wound began to discharge yellow pus. She was, however, allowed up on the twentieth day and was discharged improved on the thirty-first day post-operationem. Her maximum temperature was $102\frac{1}{5}$, rectal, on the second day after operation and her maximum pulse rate was 132 per minute on the same day. The pathological report from the laboratory was "polypoid adenocarcinoma of

LEIOMYOMA OF THE JEJUNUM WITH INTUSSUSCEPTION

the jejunum". "The tumor has all the morphology of malignancy, being an adenocarcinoma, though still polypoid and not excavated."

LEIOMYOMA OF THE JEJUNUM WITH INTUSSUSCEPTION

DR. NATHAN W. GREEN presented a man, age about sixty-seven, who was admitted to the medical service of Doctor Frissell June 17, 1927. His chief complaint was abdominal pain for six months. About two years previous

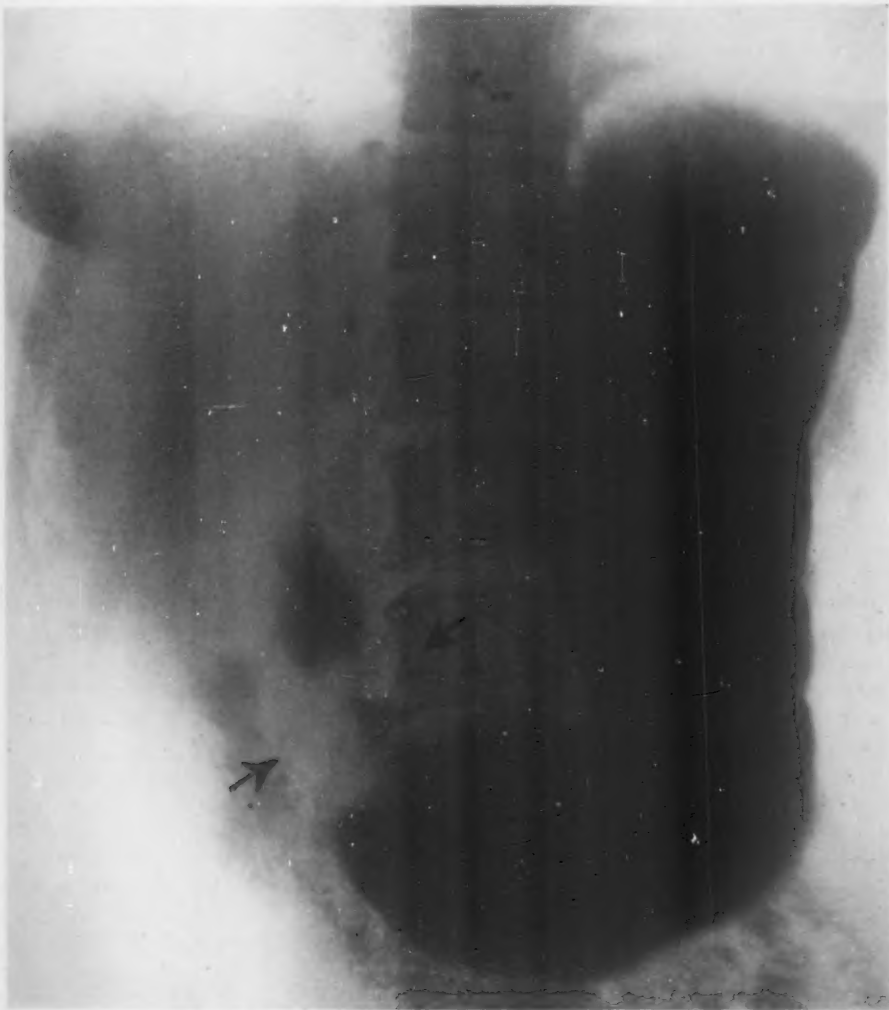


FIG. 1.—May 24, 1927. Before operation showing prepyloric filling defect.

to admission he began having frequency and urgency of urination and had some genito-urinary treatment. About six months previous to admission he began having intermittent attacks of belching, chiefly directly after meals. This improved somewhat after several months but still remained. About the same time he began having pain in his abdomen. This usually appeared in the epigastrium, but not infrequently it lay on the left side at the level of the umbilicus. The pain was dull and each attack lasted several hours.

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No relation to meals, but if he ate much the pain was more severe. He grew progressively more constipated. About three months previous to admission he began to lose strength and appetite. He lost nine pounds in three months previous to admission. His pain had increased in duration and his abdomen had become distended. He had noticed a lump in his left lower abdominal quadrant. No blood in stools.

On physical examination nothing was found which bore directly on the abdominal condition except that he had a movable mass in the left upper quadrant which extended downward and inward. The abdomen was soft and there was slight tenderness in the epigastric region. There was a left inguinal hernia and a right hydrocele. After a test meal there was present 21 per cent. free hydrochloric acid. On June 21, 1927, he was transferred to the Surgical Service, Division A. June 22, 1927, he received 500 c.c. of blood transfused. June 24, 1928, he was operated upon by Doctor Green and Doctor Cattell for resection of the tumor. About eighteen inches from the ligament of Treitz was found an annular firm mass about the size of a bantam's egg, having a nodular surface near the mesentery about the size of a hazel nut. This was of a reddish-gray color. Just above the tumor the intestine was intussuscepted over the mass for a short distance (2 cm.). This was easily straightened. There was no evidence of inflammation present except a small amount of free fluid in the abdominal cavity due probably to irritation. About five inches of the jejunum were removed with the tumor and with a V-shaped portion of the mesentery. The stumps were crushed, tied and inverted with purse-string sutures and a side-to-side anastomosis performed. He made an uninterrupted recovery and was discharged improved seventeen days after his operation.

The pathologist, Dr. L. C. Knox, called the tumor a leiomyoma of the jejunum. After a description of the morphology, the following sentence concludes the report: "The tumor is of the type which might be expected to recur rapidly if not entirely excised, but which metastasizes only late".

RESECTION OF THE PYLORIC END OF THE STOMACH

DR. NATHAN W. GREEN presented a woman, age forty-four years, who was admitted to the Memorial Hospital, May 20, 1927. Her illness began in March, 1927, with pain in the lower left quadrant and changes in the menstrual period and increasing vaginal discharge. About the same time she began to have gastric symptoms. Eructations of gas and acid fluid, no vomiting, associated both before and after meals with pain in upper right quadrant and epigastrium. Her appetite was fair but she was afraid to eat. Examination on admission showed the upper half of the abdomen negative; all her symptoms were referable to lower part, left and right, where there was some tenderness. Pelvic examination showed presence of a small fibroid left and anteriorly. An X-ray taken May 25, 1927, by Doctor Herendeen showed a constant filling defect in the prepyloric region. The remainder of the stomach appeared normal. Only a trace of barium remained at six hours. Hyperactivity in the colon. Examination of the colon was negative. Wassermann reaction was negative. The result of test meals: May 23, 1927, showed 15 free hydrochloric acid, 90 total, negative for blood. May 26, 30 free hydrochloric acid, total 60, lactic acid negative.

Urine examination on May 26 showed (phenol-sulpho-phthalein) first hour, 10 per cent.; second hour, 20 per cent.; total, 25 per cent. Blood urea nitrogen on May 26, 7.2 mgm. Hæmoglobin, May 24, was 80 per

RESECTION OF THE PYLORIC END OF THE STOMACH

cent.—red blood cells 3,880,000, white blood cells 7,400. June 13, 85 per cent.—red blood cells 4,400,000, white blood cells 12,600. June 17, 75 per cent.—red blood cells 4,112,000, white blood cells 13,600. July 1, 85 per cent.

Operation June 15, 1926, by Doctors Green and Adair, partial gastrectomy taking pylorus with it and repair by modified Billroth No. 1 under



FIG. 2.—April 19, 1928. Ten months after operation. Showing rapid and satisfactory emptying of stomach. There was no four hour residue.

gas oxygen and ether anæsthesia. Time of operation was one hour and fifty minutes. An excerpt from the pathological report said "no gross evidence of carcinoma seen. Stomach shows marked hypertrophic gastritis with broad flat ulceration. The base of the ulcer is infiltrated with alveolar and diffuse carcinoma. Diagnosis: Ulcerating gastric carcinoma, lymph-nodes free".

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Specimen measured 7 by 4 cm. pyloric end of stomach and 2 cm. duodenum. Ulcer 1 by 1 cm. The patient was discharged without incident July 4, 1927. At intervals beginning July 16, 1927, she received irradiation by the radium element pack, extending over forty-one days, 90,000 millicurie hours divided about evenly (five anterior pyloric region and five posterior pyloric region). The number of millicuries in the pack was 4,000. The maximum time of administration was three hours. The filter was 2 mm. brass and $\frac{1}{2}$ mm. platinum. The distance was uniformly 15 centimetres. April 18, 1928, her hæmoglobin was 80 per cent.—red blood cells 3,960,000, white blood cells 6,600. On the same day she looked pale but had gained weight and was vigorous. She had gained thirty-two pounds since her operation according to her observation. Weight April 18, 1928, was 136 pounds, which was twelve pounds above her normal state of nutrition.

DR. CONSTANTINE J. MACGUIRE, JR., referred to a patient he had shown before this society a year ago as a good result of a resection with end-to-end anastomosis for annular carcinoma of the jejunum. The patient, however, died recently of metastasis. The patient was shown one year after the resection. He felt that there was a poor prognosis in Dr. Green's case.

LUNG ABSCESS—TWO-STAGE DRAINAGE OPERATION

DR. NATHAN W. GREEN presented a woman, age forty-three, who was admitted to the Medical Service, St. Luke's Hospital, April 30, 1927. Chief complaint was cough and sputum. Nine months previous to admission she had an attack of pneumonia and was in bed for five weeks. Then she went to work, but a slight cough persisted. This did not trouble her much and she was not raising any sputum so she let it go until December, 1926, five months ago, when her cough increased, became harsh and she began to cough up phlegm-like material with lumps of greenish pus. Also with the most violent attacks of coughing she would have a pain in her left side posteriorly similar to the one she had when she had pneumonia. She went to the mountains; her cough and expectoration continued and her sputum began to be blood-tinged and continued so until admission to the hospital. She grew somewhat weaker and "lazier", but gained weight and said she did not have any fever. Three weeks previous to admission after an exceptionally bad coughing spell she said she spit up a large pus basin full of the bloody sputum.

Physical Examination.—Breath sounds slightly increased at the angle of the left scapula. She was bronchoscoped May 11, 1927, and 10 c.c. lipiodol injected and then sent to the X-ray room. She was discharged June 13, 1927, improved. The X-ray report dated May 11, 1927, read as follows: The shadow originally described has become subsequently somewhat larger and of a more indefinite outline with an area of evident disintegration near its centre, lying between the shadows of the first and second anterior ribs. It is thus much more characteristic of a pulmonary abscess. July 6, 1927, X-ray shows "the external circumference is about the same size. There is a slightly greater degree of cavitation near the centre of the shadow". Four times the sputum was found negative for tuberculosis. Three times the sputum was found negative for streptothrix. Her Wassermann reaction was negative. Following two injections of salvarsan 0.3 gm. the temperature dropped at first to 100° and then to normal. She was discharged June 13, 1927, with the following note: "At discharge the patient seems much better although she still continues to spit blood and much pus. X-ray shows that

HÆMATOMA IN SHEATH OF RECTUS ABDOMINALIS

process is healing. It is thought that the salvarsan helped the condition—although spirochætæ were never demonstrated."

June 30, 1927, she was again admitted to the hospital with the observation that she had been raising some blood until three days before readmission and had been raising five or six ounces of sputum a day. On reëxamination the left lung was found slightly dull throughout, but particularly so in the upper lobe. August 18, 1927, she was transferred to the Surgical Service of Division A. August 19, 1927, under ethylene anæsthesia, the first stage thoracoplasty was performed by Doctor Green. The incision followed the course of the fourth rib. Portions of the third, fourth and fifth ribs were resected subperiosteally on the left side. Gauze was packed into the wound extensively to produce wide adhesion between the two layers of pleura, and pressure was applied to collapse the lung to a slight degree.

August 30, the second stage for drainage of the abscess was carried out. The packing which had remained since the previous stage was removed and the lung through the adherent area was explored with a needle and this was followed by blunt dissection. The walls of the cavity which was irregular were broken down and the cavity packed with iodoform and plain gauze. No cautery was used. The iodoform gauze was placed *in situ* for the purpose of casting a shadow by the X-ray. The patient remained in the Surgical Service until December 20, 1927, when she was discharged to a convalescent home with the following note: "Patient had first stage thoracoplasty done August 19, 1927, and ten days later the second stage. Temperature remained elevated and patient drained properly and expectorated large quantities for weeks, was up in chair daily for short time after about ten days. Had periods of relatively high and low temperature for about eight weeks. On sixty-fourth day developed pneumonia which subsided in about a week and temperature came down to normal to remain. Was given four doses of neo-salvarsan at weekly intervals and rapid improvement was noted. Discharged to convalescent home. Bronchial fistula present, no cough, little drainage and no sputum or drainage."

HÆMATOMA IN SHEATH OF RECTUS ABDOMINALIS

DR. FORDYCE B. ST. JOHN presented a woman, thirty-five years of age, who was admitted to the hospital of the Rockefeller Institute March 12, 1926, complaining of sore throat, pains in the chest and cough for three days. The past history was negative except for an operation for uterine tumor eight years before and chronic constipation.

Upon admission, the temperature was 103; pulse, 104; respiration, 23. There were no definite signs in the chest. Throat was red. Urine negative. White blood cells 3,800, polymorphonuclears, 87 per cent.

Eight days after admission the patient complained of pain in the right lower quadrant, lasting for several hours. Examination of the abdomen was negative. Two days later, while leaning over in bed, the patient complained of very severe pain in the same location, and upon examination a very tender swelling in the region of the right rectus was noted. This persisted and was associated with moderate rigidity of that quadrant. White blood cells, 8,100. Temperature, 98.5 to 100°. Pulse, 80 to 88. The next day the pain was somewhat less but the tenderness over the mass was more marked. He saw the patient at this time and found the abdominal wall relaxed, except the lower half of the right rectus where a firm mass presented, which was very tender. Pelvic examination was negative.

A lower right rectus incision made over the mass revealed a hæmatoma in and around the rectus muscle, consisting of old and darkened blood

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clots, infiltrating the muscle, and measuring 6 by 2 by 3 centimetres. The clot was evacuated and cultured, after which the posterior sheath was opened, the peritoneal cavity explored and found to be normal. The appendix was removed. In the closure a small rubber drain was left in the region of the clot. Microscopic report of the appendix showed it to be relatively normal.

At the present time, after two years, the wound is firm. Patient slightly constipated with occasional attacks of indigestion.

TRAUMATIC OSSIFYING MYOSITIS

DR. FORDYCE B. ST. JOHN presented a girl, twenty-one years of age, who was admitted to the Presbyterian Hospital August 10, 1926, complaining of pain in the right gluteal region.

About twelve weeks before admission the patient suddenly experienced a sharp but not very severe pain in the right buttock. This persisted for several days, causing her to limp while walking. Rest in bed caused temporary relief, but the pain recurred when she began walking again, only to disappear with rest as before. She remembered no trauma, no infection or abrasion of the foot or extremity. She had had no recent boils. There were no constitutional symptoms except for a slight loss of weight. She had noted no lump or deformity, but had been told that one was present. Within the two weeks just previous to admission the pain had not responded to rest in bed.

Additional information presented by the patient's brother, a physician, was to the effect that the pain was referred to the knee, calf and heel; that a complete neurological examination had been negative, and that many forms of conservative therapy had been of no avail.

Physical examination revealed a well-nourished young female. The general examination was negative. Locally there was found in the region of the right gluteus maximus a firm, hard tumor, very slightly tender, and apparently firmly attached to the deeper structures. The gluteal fold had disappeared. Motion at the hip was practically normal. The tumor roughly measured 10 by 15 by 10 centimetres.

X-ray examination revealed a loosely arranged spherical bony mass, with delicate trabeculae, apparently not attached to the femur or ileum.

August 12, 1926, a long oblique incision in the direction of the fibres of the gluteus maximus was made. The fibres appeared pale and atrophic. A tumor mass, globular in nature, measuring 10 by 6 by 6 centimetres, was found incorporated in the maximus and medius muscles, intimately associated with, but not actually attached to the capsule of the joint. The mass was removed with care, along the sciatic nerve, upon the sheath of which it was resting.

Pathological examination shows a lobulated, well-defined mass of cancellous bone, 6 by 4.5 by 6 centimetres. For the most part this is encapsulated by a well-defined plane of connective tissue, but there are two or three small areas of bone formation outside the main mass, and near these the capsule is not so well marked. The interior of the bony mass is made up of fibrous tissue. The bone is sufficiently soft to be cut with a sharp knife. Microscopic examination showed actively growing bone trabeculae, separated by very cellular loose connective tissue; stroma in which there are great numbers of blood-vessels. No cartilage is seen. In the capsule of the tumor, with van Gieson's stain, remnants of striated muscle are seen. Sections of muscle beyond the tumor show degenerative changes similar to those in the capsule of the tumor.

Diagnosis.—Traumatic ossifying myositis. (Note: As there is no clin-

TRAUMATIC HÆMOTHORAX

ical history of trauma, this diagnosis is perhaps not entirely justified. The pathological evidence is degenerated muscle and hetero-plastic bone. Dr. Kneeland Frantz.)

Follow-up.—(Five months.) Patient feels well. Is active. No pain. Right thigh is as strong as the left. Examination reveals a good scar, movable, no tenderness or induration, no evidence of mass.

TRAUMATIC HÆMOTHORAX

DR. FORDYCE B. ST. JOHN presented a boy, twelve years of age, who was brought to the Emergency Department of the Presbyterian Hospital January 18, 1925, with the following history:

Ten minutes before coming in he had lost control of his sled while coasting in the park and had run into a tree, the side of the sled striking him on his left side. Almost immediately he vomited. A passing pedestrian advised him to come to the hospital.

Examination revealed a boy obviously suffering from a moderately severe grade of chorea. There was no evidence of head injury. The chest was entirely negative and there was no ecchymosis or tenderness over the ribs. The abdomen was soft, with no tenderness to be elicited. The patient was referred to the clinic the following day, however, for further observation.

He returned to the clinic, as advised, and a complete examination failed to reveal evidence of injury, lungs and abdomen being negative. At this time the patient was seen by one of the visiting physicians and was told to return in one week.

Four days later, he was brought in with a temperature of 103, pulse 104, respiration 42. He was coughing, and was obviously acutely ill. Blood count 27,300, polymorphonuclears 76 per cent., red blood cells 4,360,000, hæmoglobin 85 per cent. Examination showed diminished respiratory excursion of the lower left chest with no tenderness. There were typical signs of fluid in the lower left chest. The heart had apparently not shifted. The abdomen was soft.

Aspiration of the left chest revealed 150 c.c. of dark blood-stained fluid, with negative culture. The blood culture also was negative. Three more chest taps within ten days all showed foul-smelling, old, bloody fluid, with growth of hæmolytic staphylococcus aureus. The temperature remained up. White blood cells around 23,000. The patient was transferred to the surgical service, where two more aspirations revealed the same foul-smelling pus.

February 12, 1925, an incision was made over the eighth and ninth ribs in the left posterior axillary line. Aspiration over this site gave one the sense of passing through semi-solid tissue and resulted in the recovery of foul, reddish exudate. After sub-peritoneal resection of portions of the eighth and ninth ribs, the parietal pleura was incised, with the escape of no exudate. Inspection of the pleural cavity revealed no collection of pus, but there were freshly-formed fibrinous adhesions. The diaphragm was then incised, and the sub-phrenic space found to be clear of infection. The left lobe of the liver was aspirated, and on the third attempt, the same foul-smelling reddish exudate as had previously been obtained was obtained at a depth of 2.5 centimetres. The pleural cavity was closed off, except for individual air-tight drainage, the diaphragm sutured to the parietal pleura, and the liver abscess drained. Culture of the pus showed hæmolytic staphylococcus aureus.

After a stormy course, which was prolonged, including two explorations of the liver sinus tract in search of walled off pockets, the patient made a complete recovery.

Follow-up.—(Thirty-nine months.) Chest is essentially negative. The

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boy apparently is normal, except for his constitutional type and obesity, having gained 125 pounds since operation.

HÆMATOMA OF THIGH AND PELVIC REGIONS

DR. FORDYCE B. ST. JOHN presented a woman, fifty-one years of age, who was admitted to the Presbyterian Hospital April 15, 1928, with the following history:

The patient presents a history of congenital dislocation of both hips, which has caused surprisingly little discomfort or inconvenience. She has led a very active life, walks with but a very slight limp, has always done her own housework, and has been married for twenty-four years. She has been pregnant six times, with five full-term babies. Two of her children are living. Until onset of the present illness she has enjoyed dancing and skating among her other activities.

Two years ago she noticed a slight pain which resulted in extensive ecchymosis and swelling of the left inguinal region and the upper one-third of the thigh. This appeared spontaneously and disappeared with rest in bed, leaving no after effects.

Seven months before admission she again noticed ecchymosis in the left femoral and inguinal region with very little swelling and pain. Rest in bed was followed by complete disappearance of symptoms.

Two months before admission, during the act of defecation, she experienced very great pain in the lower left abdomen, inguinal and femoral regions. She noticed swelling in the inguinal region, and later ecchymosis.

When first examined there was a definite mass on the antero-lateral aspect of the upper femoral and inguinal regions, apparently continuous with a mass on the left lateral aspect of the pelvis. Vaginal examination was negative. There was slight tenderness over the mass and no ecchymosis.

X-ray examination showed a dislocation of both femora and absence of heads. The remaining portions of the necks of the femora articulate with the ileum. In addition, the upper half of the shaft of the left femur is decalcified and the cortex quite irregular. This process seems to begin about at the level of the lesser trochanter and extends downward for a distance of about 5 centimetres. Soft shadows can be seen radiating outward from the cortex around the entire circumference of the bone.

Exploration revealed a very large hæmatoma deep to the vastus externus, rectus femoris, and femoral vessels, extending along the iliacus muscle and retro-peritoneal tissue. Pressure over the lateral pelvis expressed clots into the wound. The upper extremity of the femur was inspected on its anterior aspect and carefully palpated, but no gross evidence of neoplasm could be made out. The large blood clots were expressed, loose packing gently inserted, with a soft drain.

Pathological examination of the material removed has failed to show evidence of neoplasm, nothing but blood clot being noted. Convalescence has been uneventful.

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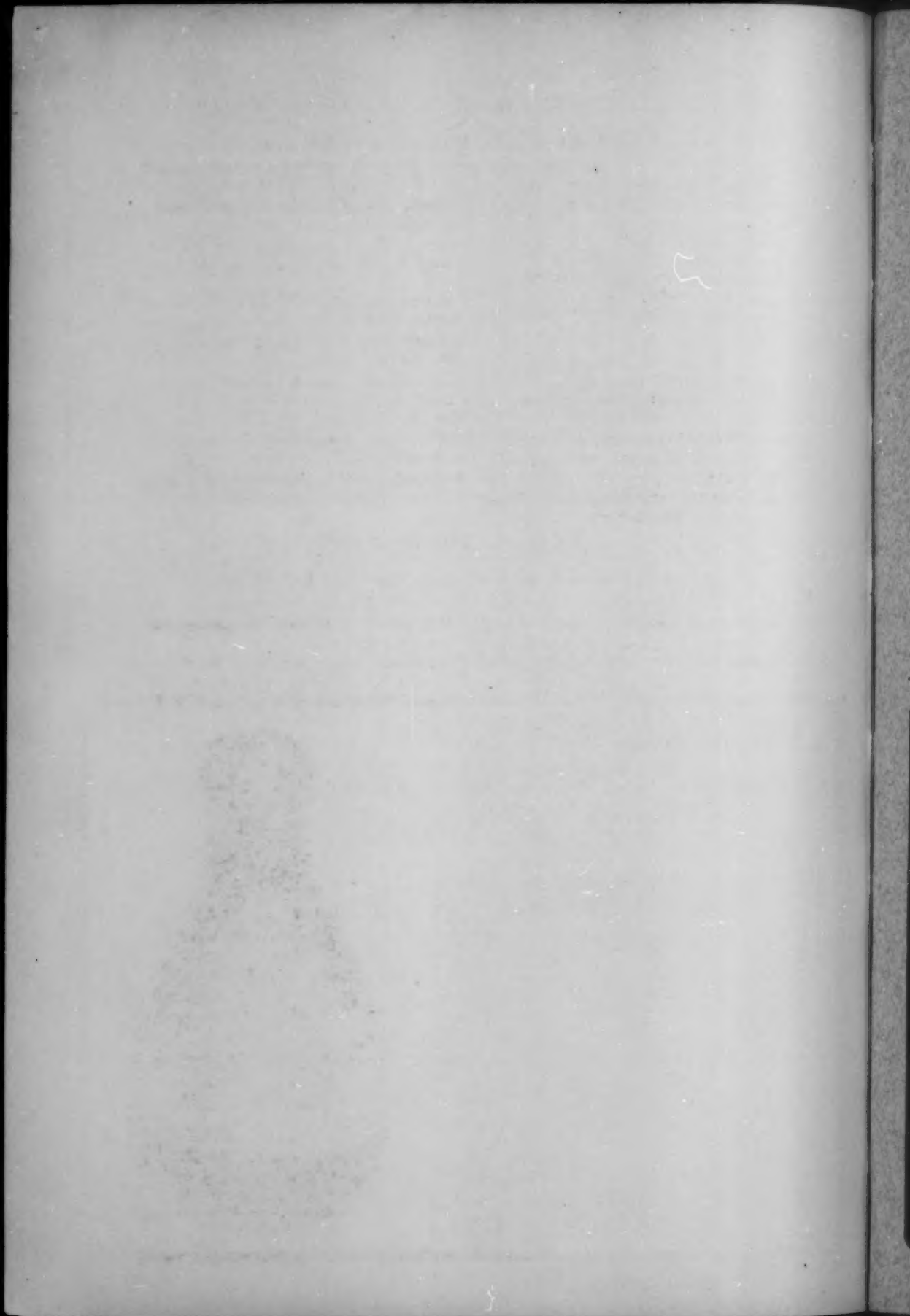
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